

ALIGNING TECHNOLOGIES AND INTERORGANIZATIONAL NETWORKS IN IMPLEMENTATIONS: THE CASE OF A NEW HEALTH SCREENING PROGRAM

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à Catarina

ao Miguel

à Isabel

ABSTRACT

This thesis is motivated by the importance of technology implementation projects for networks of preventive healthcare providers to fully benefit from the technologies that they adopt. The focus of the research is on implementation processes, conceptualized as sequences of alignment between the technology and the adopter. The main goal of the thesis is to improve the current understanding about technology implementation projects, specifically by answering the following research question: “How do technology and its adopters align during its implementation in networks of organizations?”

The research work was divided in three parts. In a first part, a systematic literature review about sequences of alignment in implementations of technology in networks of organizations was carried out, to establish the current knowledge basis for the topic (Chapter 2). As part of its results, the review suggested directions for future research, some of which frame the scientific and practical relevance of the other two parts of the work. The review confirmed the lack of a systematic presentation of results concerning sequences of alignment, the key motivation for a second part of the work (Chapter 3), in which classification schemes for misalignments and alignment efforts were proposed, based on a literature review and on an inductive multiple case research about implementations of a new health screening program in several networks of healthcare providers in the North of Portugal. In a third part of the research (Chapter 4), the data from the multiple case research were used to improve the understanding of the reasons, consequences, and management of sequences of alignment, namely non-linear and cascading sequences, which the systematic literature review also confirmed as important mechanisms in implementations of technologies in networks.

This thesis contributes to the technology management field of research, and also provides some insights for implementation managers. The three parts of the research work led to a conceptual framework that systematizes current knowledge about sequences of alignments in implementations of technologies in networks of organizations, classification schemes for misalignments and alignment efforts included in those sequences of alignment, and a set of propositions and recommendations concerning non-linear and cascading sequences of alignment.

RESUMO

Esta tese é motivada pela importância que os projetos de implementação de tecnologias têm para que redes de prestadores de cuidados preventivos de saúde beneficiem plenamente da sua adoção. O foco da investigação são os processos de implementação, entendidos como sequências de alinhamentos entre a tecnologia e a rede adotante. O principal objetivo da tese é melhorar o conhecimento disponível sobre projetos de implementação de tecnologias, respondendo concretamente à seguinte questão de investigação: “Como é que uma tecnologia e o seu adotante se alinham durante a sua implementação em redes de organizações?”

O trabalho científico dividiu-se em três partes. Numa primeira parte, foi realizada uma revisão sistemática da literatura sobre sequências de alinhamento em implementações de tecnologias em redes de organizações, para estabelecer a base de conhecimento disponível sobre o tema (Capítulo 2). Parte dos resultados da revisão consistiu de sugestões de linhas de investigação futura, algumas das quais enquadram a relevância científica e prática das outras duas partes do trabalho. A revisão confirmou a falta de uma forma sistemática de apresentar resultados sobre sequências de alinhamento, principal motivação para uma segunda parte do trabalho (Capítulo 3) em que foram propostos esquemas de classificação para desalinhamentos e esforços de alinhamento, baseados numa revisão da literatura e num estudo de caso múltiplo e indutivo sobre a implementação de um rastreio de saúde em redes de prestadores de cuidados de saúde do Norte de Portugal. Numa terceira parte do trabalho (Capítulo 4), os dados do estudo de caso foram utilizados para melhorar o conhecimento sobre as razões, consequências, e gestão de sequências de alinhamento, nomeadamente sequências não-lineares e em cascata, que a revisão sistemática da literatura tinha também confirmado como mecanismos importantes nas implementações de tecnologias em redes.

Esta tese contribui para a área de investigação da gestão da tecnologia, e propõe algumas recomendações para gestores de implementações. Das três partes do trabalho de investigação resultaram uma ferramenta conceptual que sistematiza o conhecimento atual sobre sequências de alinhamento em implementações de tecnologias em redes de organizações, esquemas de classificação para desalinhamentos e esforços de alinhamento incluídos nessas sequências de alinhamento, e um conjunto de proposições e recomendações sobre sequências de alinhamento não-lineares e em cascata.

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CONTENTS

ABSTRACT.....	V
RESUMO.....	VII
ACKNOWLEDGEMENTS	IX
CONTENTS	XI
LIST OF TABLES	XV
LIST OF FIGURES.....	XVII
LIST OF ABBREVIATIONS AND DEFINITIONS.....	XIX
1 INTRODUCTION	1
1.1 MOTIVATION AND OVERVIEW.....	1
1.2 BACKGROUND AND KEY CONCEPTS	4
1.2.1 <i>Implementations of technologies</i>	4
1.2.2 <i>Implementations as sequences of alignments</i>	11
1.2.3 <i>Implementations and networks</i>	13
1.3 RESEARCH OBJECTIVES AND METHODOLOGY	15
1.4 THESIS OUTLINE.....	18
2 ALIGNING TECHNOLOGIES AND NETWORKS IN IMPLEMENTATION PROJECTS: A SYSTEMATIC LITERATURE REVIEW.....	21
ABSTRACT	21
2.1 INTRODUCTION.....	22
2.2 METHOD	24
2.2.1 <i>Review protocol</i>	25
2.2.2 <i>Search strategy</i>	25
2.2.3 <i>Selection of papers for review</i>	26
2.2.4 <i>Data analysis</i>	27
2.2.5 <i>Synthesis of findings</i>	28
2.3 GENERAL CHARACTERISTICS OF THE REVIEWED STUDIES	28
2.4 FINDINGS	33
2.4.1 <i>Alignment process at the adoption decision stage</i>	35
2.4.2 <i>Alignment process at the implementation stage</i>	36
2.4.3 <i>Impact on performance and outcome of the process</i>	44

2.4.4	<i>Conceptual framework</i>	46
2.5	DISCUSSION AND FUTURE RESEARCH.....	49
2.5.1	<i>Adoption decision</i>	49
2.5.2	<i>Implementation</i>	50
2.5.3	<i>Implementation outcome</i>	54
2.6	CONCLUSION.....	55
	PAPERS INCLUDED IN THE SYSTEMATIC LITERATURE REVIEW	58
3	CLASSIFICATION SCHEMES FOR MISALIGNMENTS AND ALIGNMENT EFFORTS DURING TECHNOLOGY IMPLEMENTATIONS IN NETWORKS	63
	ABSTRACT.....	63
3.1	INTRODUCTION.....	64
3.2	METHOD	67
3.2.1	<i>Literature review</i>	68
3.2.2	<i>Multiple case research</i>	69
3.3	MISALIGNMENTS.....	74
3.3.1	<i>Context misalignments</i>	76
3.3.2	<i>Structural misalignments</i>	78
3.3.3	<i>Technical misalignments</i>	81
3.3.4	<i>Capacity misalignments</i>	87
3.4	EFFORTS TO ALIGN NETWORK AND TECHNOLOGY	90
3.4.1	<i>Structural alignment efforts</i>	93
3.4.2	<i>Technical alignment efforts</i>	98
3.4.3	<i>Capacity alignment efforts</i>	108
3.5	DISCUSSION.....	110
3.6	CONCLUSION	114
4	SEQUENCES OF ALIGNMENT BETWEEN TECHNOLOGIES AND ADOPTERS: CASE RESEARCH OF IMPLEMENTATIONS OF A NEW HEALTH SCREENING PROGRAM	117
	ABSTRACT.....	117
4.1	INTRODUCTION.....	118
4.2	METHOD	123
4.2.1	<i>Diabetic retinopathy screening program</i>	123
4.2.2	<i>Research design and sampling</i>	125
4.2.3	<i>Data collection</i>	126
4.2.4	<i>Data analysis</i>	128
4.3	FINDINGS	129

4.3.1	<i>Within case analysis</i>	129
4.3.2	<i>Cross-case analysis</i>	141
4.4	NON-LINEAR AND CASCADING SEQUENCES OF ALIGNMENT	150
4.4.1	<i>Non-linear sequences of alignment</i>	152
4.4.2	<i>Cascading sequences of alignment</i>	161
4.4.3	<i>Network level complexity for implementation management</i>	165
4.5	CONCLUSIONS	167
4.5.1	<i>Reasons for non-linear and cascading sequences</i>	168
4.5.2	<i>Managing non-linear and cascading sequences</i>	170
4.5.3	<i>Consequences of non-linear and cascading sequences</i>	171
4.5.4	<i>Network level complexity</i>	173
4.5.5	<i>Implications for practice</i>	173
5	CONCLUSION	177
5.1	THEORETICAL CONTRIBUTIONS	177
5.2	PRACTICAL IMPLICATIONS	181
5.3	LIMITATIONS	183
5.4	FUTURE WORK	184
6	REFERENCES	187
7	APPENDIX A	209
8	APPENDIX B – PROTOCOL USED IN THE CASE RESEARCH	213
9	APPENDIX C – INFORMED CONSENT	219
10	APPENDIX D – INTERVIEW GUIDES	223

LIST OF TABLES

TABLE 2.1 – PAPER SELECTION PROCESS.....	26
TABLE 2.2 – LIST OF CODES USED IN DATA ANALYSIS AND NUMBER OF SEGMENTS CODED.....	27
TABLE 2.3 – NUMBER OF PAPERS INCLUDED IN THIS REVIEW PER JOURNAL	30
TABLE 2.4 – MAIN FOCI OF THE REVIEWED PAPERS	32
TABLE 2.5 – STAGES OF THE IMPLEMENTATION PROCESS ADDRESSED IN EACH REVIEWED PAPER	33
TABLE 2.6 – ALIGNMENT EFFORTS ADDRESSED IN THE REVIEWED PAPERS	33
TABLE 2.7 – ALIGNMENT PROCESSES AND CONCERNS PROPOSED IN THE REVIEWED PAPERS	41
TABLE 2.8 – LIST OF PAPERS THAT STUDY THE STRUCTURAL AND TECHNICAL ALIGNMENT EFFORTS	43
TABLE 2.9 – MAIN RESEARCH TOPICS OF PAPERS INCLUDED IN THE REVIEW, EXCLUDING ALIGNMENT EFFORTS....	50
TABLE 3.1 – DESCRIPTION OF CASES (THE RHA LINE IS NOT A CASE, IT JUST RECORDS THE TWO MANAGERS WITH THE RESPONSIBILITY FOR ALL THE IMPLEMENTATIONS, WHO ARE BASED IN THAT INSTITUTION)	72
TABLE 3.2 – CLASSIFICATION SCHEME PROPOSED FOR MISALIGNMENTS.....	76
TABLE 3.3 – SUMMARY OF THE MISALIGNMENTS IDENTIFIED IN THE CASE RESEARCH, AND THE NETWORKS IN WHICH THEY WERE IDENTIFIED	76
TABLE 3.4 – PARTICIPATION IN THE SCREENING PER NETWORK AND PCC GROUP (INCLUDING THE NUMBER OF ROUNDS COMPLETED, THE DATE OF THE BEGINNING OF THE FIRST ROUND, THE TOTAL NUMBER OF PATIENTS CALLED PER ROUND, AND THE NUMBER AND PERCENTAGE OF PARTICIPANTS PER ROUND)	82
TABLE 3.5 – CUMULATIVE NUMBER OF PATIENTS THAT INITIATED TREATMENT PER NETWORK	90
TABLE 3.6 – CLASSIFICATION SCHEME PROPOSED FOR ALIGNMENT EFFORTS.....	92
TABLE 3.7 – SUMMARY OF THE ALIGNMENT EFFORTS IDENTIFIED IN THE CASE RESEARCH, AND THE NETWORKS IN WHICH THEY WERE IDENTIFIED	93
TABLE 3.8 – RELATION BETWEEN ALIGNMENT EFFORTS FOUND IN THE LITERATURE AND THROUGH CASE RESEARCH	94
TABLE 4.1 – DESCRIPTION OF CASES (THE RHA LINE IS NOT A CASE, IT JUST RECORDS THE TWO MANAGERS WITH THE RESPONSIBILITY FOR ALL THE IMPLEMENTATIONS, WHO ARE BASED IN THAT INSTITUTION)	126
TABLE 4.2 – PATIENTS SENT TO TREATMENT PER NETWORK (INCLUDING THE PATIENTS CALLED FOR TREATMENT AS A PERCENTAGE OF THE PATIENTS THAT NEEDED TREATMENT, THE PATIENTS THAT INITIATED TREATMENT AS A PERCENTAGE OF THE PATIENTS CALLED FOR TREATMENT, AND THE CUMULATIVE NUMBER OF PATIENTS THAT INITIATED TREATMENT)	131
TABLE 4.3 – PARTICIPATION IN THE SCREENING PER NETWORK AND PCC GROUP (INCLUDING THE NUMBER OF ROUNDS COMPLETED, THE DATE OF THE BEGINNING OF THE FIRST ROUND, THE TOTAL NUMBER OF PATIENTS CALLED PER ROUND, AND THE NUMBER AND PERCENTAGE OF PARTICIPANTS PER ROUND)	133
TABLE 4.4 – TOTAL READINGS PER YEAR IN THE NORTH OF PORTUGAL (INCLUDING THE TOTAL NUMBER OF RETINOGRAPHIES PERFORMED, AND THE NUMBER AND PERCENTAGE OF RETINOGRAPHIES READ, I.E. RETINOGRAPHIES WITH A REPORT)	135
TABLE 4.5 – SUMMARY OF NON-LINEAR SEQUENCES OBSERVED IN THE MULTIPLE CASE RESEARCH	142

TABLE 4.6 – SCHEMATIC REPRESENTATIONS OF THE CASCADING SEQUENCES	143
TABLE 4.7 – CASCADING SEQUENCES OF ALIGNMENT AND THEIR ORIGINS	162

LIST OF FIGURES

FIGURE 1.1 – IMPLEMENTATION ECOSYSTEM. ACTORS INVOLVED, RELEVANT ACTOR-RELATED FACTORS, AND RELATIONS BETWEEN ACTORS IN IMPLEMENTATION PROJECTS	6
FIGURE 1.2 – CHAPTERS OF THE THESIS.....	18
FIGURE 2.1 – TIME DISTRIBUTION OF THE PAPERS INCLUDED IN THE REVIEW.....	29
FIGURE 2.2 – RESEARCH METHODS USED IN THE STUDIES INCLUDED IN THE REVIEW.....	29
FIGURE 2.3 – NUMBER OF PAPERS ANALYSING IMPLEMENTATIONS OF INFORMATION SYSTEMS AND NEW WORK PROCESSES (LEFT); DISTRIBUTION OF TYPES OF INFORMATION SYSTEMS IMPLEMENTED (RIGHT).....	30
FIGURE 2.4 – INDUSTRY (LEFT) AND COUNTRY (RIGHT) DISTRIBUTIONS OF REVIEWED PAPERS	31
FIGURE 2.5 – FRAMEWORK FOR THE PROCESS OF ALIGNMENT OF SYSTEMIC TECHNOLOGIES AND NETWORKS OF ORGANIZATIONS.....	46
FIGURE 4.1 – STRUCTURE FOR THE REPRESENTATION OF SEQUENCES OF ALIGNMENT FOUND IN OUR RESEARCH	150
FIGURE 4.2 – ILLUSTRATIONS OF FINDINGS EMERGING FROM THE ANALYSIS OF THE NON-LINEAR SEQUENCES OF ALIGNMENT	151
FIGURE 4.3 – PROPOSITIONS ABOUT NON-LINEAR SEQUENCES OF ALIGNMENT	161
FIGURE 7.1 – SCREENING PROCESS DEFINED BY THE RHA	210
FIGURE 7.2 – MAP OF PCC GROUPS IN THE NORTH OF PORTUGAL (THE NETWORKS INCLUDED IN THIS RESEARCH ARE MARKED).....	211

LIST OF ABBREVIATIONS AND DEFINITIONS

ARSN	–	Administração Regional de Saúde do Norte (Regional Health Authority from the North of Portugal)
BIM	–	Building Information Modelling
CAD	–	Computer Aided Design
DSM	–	Design Structure Matrix
EDI	–	Electronic Data Interchange
ERP	–	Enterprise Resource Planning
GP	–	General Physician
IOIS	–	Interorganizational Information System
IS	–	Information System
IT	–	Information Technology
KPI	–	Key Performance Indicator
PACS	–	Picture Archiving and Communications System
PCC	–	Primary Care Centre
PCU	–	Primary Care Unit
R&D	–	Research and Development
RFID	–	Radio Frequency Identification
RHA	–	Regional Health Authority
SLR	–	Systematic Literature Review
VMI	–	Vendor Managed Inventory
WHO	–	World Health Organization
Alignment	–	Alignment, studied in this thesis with an operational perspective and not a strategic perspective, is a state that can be reached through an alignment process (Hanson et al., 2011). It can be achieved in implementation projects through efforts of change in the technology and in its adopter, with the objective of increasing the compatibility between them.
Interorganizational network	–	System of complementary products or services provided by different organizations (Hayes, 2005)

- | | |
|------------------------|---|
| Sequences of alignment | – Sequences of efforts to align the adopter and the network, triggered by, and towards overcoming, misalignments (lacks of compatibility) between them. |
| Technology | – “A body of knowledge, tools and techniques, derived from science and practical experience, that is used in the development, design, production, and application of products, processes, systems, and services” (Abetti, 1989) |

1 INTRODUCTION

1.1 MOTIVATION AND OVERVIEW

Population aging, with a growing burden of chronic diseases, is driving up the importance of preventive care, or managed care ([Goes and Park, 1997](#)), in the portfolio of healthcare operations ([Christensen et al., 2009](#), [Coughlin et al., 2006](#), [Marvasti and Stafford, 2012](#)). Chronic patients, particularly the elderly, usually present more than one condition simultaneously, interacting in unique and different ways ([Coughlin et al., 2006](#), [May et al., 2011](#)). Consequently, a combination of sequential and iterative operational modes of care tends to be adopted, due to patients' multiple conditions, to interactions between conditions, and to different degrees of knowledge held about each condition and their interactions ([Bohmer, 2005](#), [Christensen et al., 2009](#)).

Simultaneously, patients want to live independently as long as possible ([de Blok et al., 2010](#)), and have become used to a high standard of personalized and technology based care ([Coughlin et al., 2006](#)). All these facts have significant impact on healthcare systems providing preventive care, which perform distributed activities ([de Blok et al., 2010](#), [Marvasti and Stafford, 2012](#)) and involve a multiplicity of organizations that provide health, as well as social and housing, services ([Barlow et al., 2006](#), [de Blok et al., 2010](#)). This is leading to the emergence of a new value creation configuration in healthcare: value networks – systems of complementary products or services provided by a network of different organizations ([Christensen et al., 2009](#), [Stabell and Fjeldstad, 1998](#)) – aiming at responding to the specific needs of each individual as well as of the general community, and providing coherent and aligned services ([Christensen et al., 2009](#), [de Blok et al., 2010](#), [Evans and Baker, 2012](#)).

Technologies, defined as “a body of knowledge, tools and techniques, derived from science and practical experience, that is used in the development, design, production, and application of products, processes, systems, and services” ([Abetti, 1989](#), [Buganza et al., 2015](#), [Steensma](#)

[and Corley, 2001](#)), have the potential to play a major role in preventive care ([Coughlin et al., 2006](#)). They may be applied in virtually every area and level of health intervention (monitoring, management, or motivation) ([Coughlin et al., 2006](#)), and range from simple local solutions ([Coughlin et al., 2006](#)) to complex system-wide technologies ([Barlow et al., 2006](#)).

Generally, networks of organizations are coming to dominate contemporary economies. Their operations often involve technological solutions, in particular in the scope of the interactions between their organizations. Electronic data interchange (EDI) systems, radio frequency identification (RFID) systems, and other software solutions have been implemented by networks of industrial organizations to support collaborative business operations ([Cegielski et al., 2012](#), [Chwelos et al., 2001](#), [Croteau and Bergeron, 2009](#), [Bhattacharya, 2012](#)). Specific software platforms have been created to support collaborative R&D involving multiple universities and R&D organizations ([Cunha et al., 2007](#), [Grethe et al., 2005](#)). Healthcare technologies, such as electronic health records, and evidence-based practices have been adopted by networks of healthcare providers, aiming at achieving better and more integrated care ([Aarons et al., 2011](#), [Barlow et al., 2006](#), [Palinkas et al., 2014](#), [Sicotte et al., 2006](#)). These networks are challenging settings, as they typically feature complex behaviours, due to a semi-dependence structure, i.e., the fact that the organizations in the network are independent power structures, but at the same time are mutually dependent as they jointly seek to provide a competitive product or service.

The full realization of the potential of technological innovations requires a good understanding of their implementation processes, whose objective is a successful assimilation of the technology in the routine operations of the adopter ([Edmondson et al., 2001](#), [Rogers, 2003](#)). When the adopter is a network of organizations, the implementation project is particularly challenging because implementation decisions have to be orchestrated between multiple organizations ([Dhanarag and Parkhe, 2006](#), [Goes and Park, 1997](#)), and the dynamics of network evolution triggered by the implementation depend not only on the individual organizations, but also on their mutual alignment ([Hung et al., 2011](#), [Taylor, 2005](#)).

Implementations of technologies face initial losses of productivity due to misalignments between the technology and the adopter ([Basoglu et al., 2007](#), [Leonard-Barton, 1988a](#), [Wei et al., 2005](#), [Wu et al., 2007](#)), which result from a lack of compatibility between them ([Alin et al., 2013](#), [Choi and Moon, 2013](#), [Leonard-Barton, 1988a](#)). Misalignments influence

performance at different levels of the adopter (organizations, teams, and individuals, when the adopter is a network), and at each level meet with different evaluation criteria and perspectives on the implementation process ([Leonard-Barton, 1988a](#)). They usually lead to a dynamic sequence of alignment efforts between the technology and the adopter, throughout the implementation process ([Alin et al., 2013](#), [Choi and Moon, 2013](#), [Leonard-Barton, 1988a](#), [Wei et al., 2005](#)), which are thus a major challenge in implementations ([Bhattacharya, 2012](#)).

With this motivation, this thesis studies implementations of technological innovations in networks of organizations, with a particular focus on sequences of alignment between the technology and the network. For this purpose, an inductive multiple case research about the implementation of a new health screening program (the diabetic retinopathy screening program) in networks of healthcare providers was carried out. Networks of preventive healthcare providers were considered to be a relevant context to study implementations of technologies from the perspectives of sequences of alignment, due to the reasons presented in the first three paragraphs of this section: chronic diseases are driving up the importance of preventive care, healthcare systems providing preventive care perform distributed activities and involve a multiplicity of organizations organized as value networks, and technologies have the potential to play a major role in preventive care. The new health screening program, in turn, involves the implementation of a system of technologies, which includes portable retinographers to perform the exam, a software to support the activities and information flows involved in the screening, and a screening process based on the recommendations of the World Health Organization. The screening process defines the business processes, their workflow and the methods and materials to be used in the screening program.

This introductory chapter presents an overview of implementations of technologies, focusing in particular in networks of organizations as adopters and explaining the perspective of operational alignment, and defines the objectives of the thesis. It is organized as follows. Sections 1.2, 1.3, and 1.4, introduce the main topic of the thesis and provide a global overview of the current knowledge about, respectively, implementations of technologies, implementations as processes of sequences of alignment, and specific challenges when the implementation occurs in a network of organizations. Section 1.5 presents the research objective proposed for this thesis, the related research questions, and the methodology used. Finally, Section 1.6 presents a synopsis of the remaining chapters of the thesis.

1.2 BACKGROUND AND KEY CONCEPTS

1.2.1 IMPLEMENTATIONS OF TECHNOLOGIES

For organizations and networks of organizations, the decision to adopt may be only a first – and often far from sufficient – step in integrating a new technology into the on-going work of the organization and obtaining benefits from its routine use ([Edmondson et al., 2001](#), [Rogers, 2003](#)). The implementation process is very important for the assimilation of the technology, because many users have to adopt it and to adapt their routines to use it ([Greenhalgh et al., 2004](#), [Leonard-Barton, 1988a](#), [Rogers, 2003](#)).

Implementation includes activities ranging from the decision to adopt to the incorporation of the technology in the routines of the adopter, or its abandonment. Three main stages can be identified in the implementation process: adoption decision, implementation, and assimilation ([Greenhalgh et al., 2004](#), [Rogers, 2003](#)). The implementation is initiated by an adoption decision made by a restricted group of decision makers within the adopter's structure ([Gallivan, 2001](#)). Then, during the implementation stage, efforts are initiated to include the technology in the routine operations of the adopter and to align the adopter and the technology to better fit the operations and the expected outcomes ([Gallivan, 2001](#), [Greenhalgh et al., 2004](#), [Rogers, 2003](#)). At this stage the technology is being gradually adopted by the users, with the assistance of training sessions and other efforts to promote the acceptance of the technology ([Gallivan, 2001](#)). The implementation and assimilation stages are intermingled. In the assimilation stage, efforts to routinize and incorporate the technology continue, but the technology is already fully working within the adopter's operations and begins to lose its external identity by becoming an ongoing element of those operations ([Rogers, 2003](#)).

The implementation outcome rises throughout the implementation process, and thus it is important to clearly define and keep track of it ([Klein and Sorra, 1996](#)). Four areas must be considered when defining and measuring implementation outcomes: (i) the change brought by the technology to the work performed; (ii) the change brought by the technology to the adopter's structure or to the interactions between the members of the adopter; (iii) the economic performance of the technology; and (iv) the degree of improvement in the operations (operational effectiveness) ([Linton, 2002](#), [O'Connor et al., 1990](#)). Bearing in mind the difficulty of finding measures that cover all these areas without being subjective,

simplistic, or unreliable, but with a special concern with generalizability across technologies and acceptability to practitioners and researchers, [Linton \(2002\)](#) identified three measures for implementation outcomes: routinization, incorporation, and implementation time. Routinization measures the acceptance of the technology by the adopter after the implementation is complete ([Linton, 2002](#), [Meyer and Goes, 1988](#)) through the observation of the routine use of the technology on an ongoing basis ([Edmondson et al., 2001](#)). Incorporation measures to which extent the technology is being used in full potential by the adopter, i.e., the effectiveness of the implementation process ([Linton, 2002](#)). Implementation time measures the efficiency of the implementation process: the faster the implementation process, the earlier the adopter starts benefiting from the technology ([Linton, 2002](#)).

Three possible and generic outcomes can be expected from implementation: it might be effective (when the technology's economic performance is fully realized, and it is routinized and incorporated) and enhance the performance of the adopter, because the changes that the technology brought (either changes on how work is performed or in the adopter's structure) improve operational effectiveness; or it might be effective but fail to enhance the adopter's performance, because the changes that the technology brought did not improve operational effectiveness; or it might fail ([Klein and Sorra, 1996](#)). Any of these outcomes will start to rise during the technology implementation process, influencing decisions and the motivation for the implementation, and creating feedback loops in the implementation process. When the implementation is being effective and is enhancing the adopter's performance, user support to the implementation intensifies, increasing the motivation for the implementation. On the other hand, when the implementation is being effective but does not enhance the adopter's performance or when it is not effective, support for the implementation declines, decreasing motivation and intensifying the resistance to change ([Klein and Sorra, 1996](#)).

Throughout implementations, several factors influence perceptions, decisions, and actions related to the implementation process, which in turn have an impact on its outcome ([Edmondson et al., 2001](#), [Leonard-Barton, 1988a](#)). Those factors concern the technology, the locus of adoption (organizations, or networks of organizations), and the external context of the implementation ([Berta et al., 2005](#), [Edmondson et al., 2001](#), [Fichman, 1992](#), [Goes and Park, 1997](#), [Greenhalgh et al., 2004](#), [Hausman et al., 2005](#), [Linton, 2002](#), [Meyer and Goes, 1988](#), [Rogers, 2003](#)). When the locus of adoption is an organization or a network of organizations another important set of factors that will strongly determine the implementation outcome, concerns the users who will have to incorporate the technology in their routines

1.2. Background and Key concepts

([Greenhalgh et al., 2004](#), [Leonard-Barton, 1988a](#)). These factors determine the implementation ecosystem and strongly condition the implementation process ([Berta et al., 2005](#), [Greenhalgh et al., 2004](#), [Linton, 2002](#), [Meyer and Goes, 1988](#), [Rogers, 2003](#)). Figure 1.1 presents a schematic view of the implementation ecosystem, which is explained in detail in the following paragraphs.

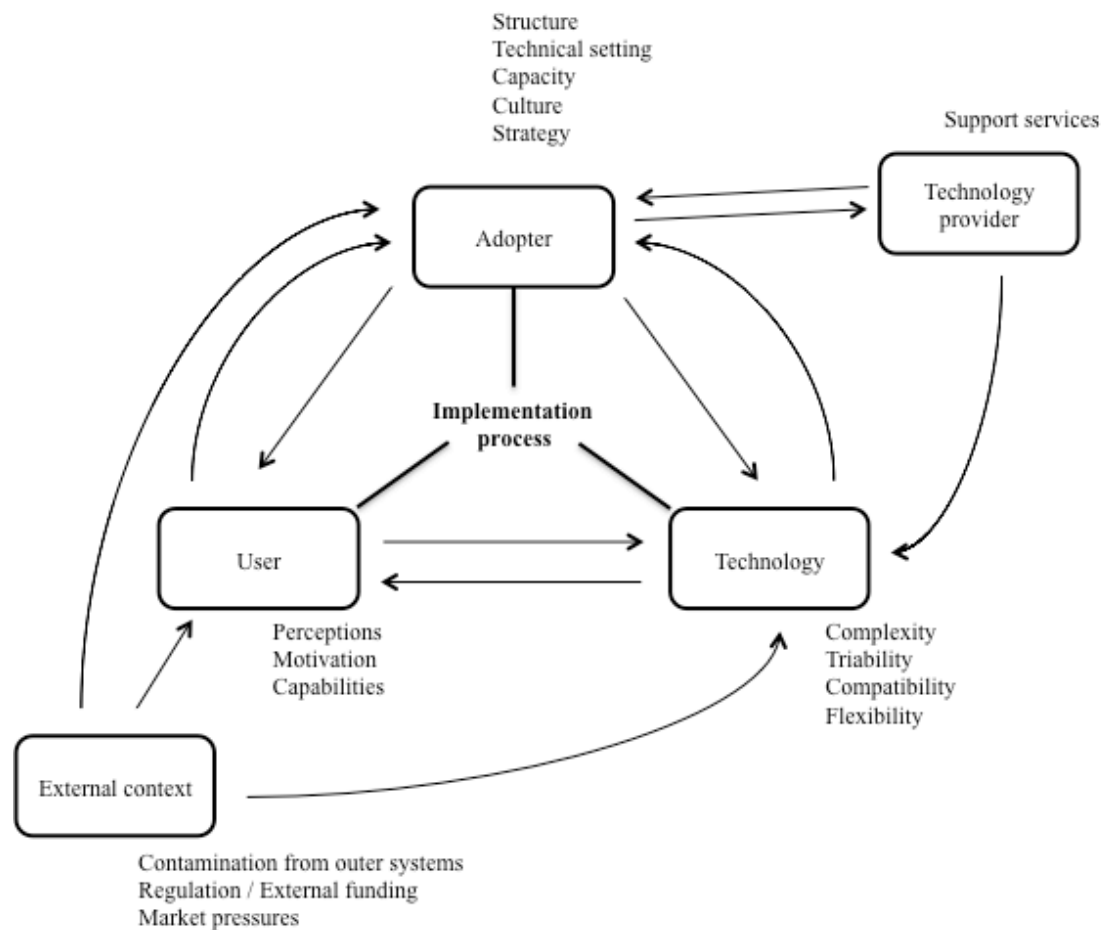


Figure 1.1 – Implementation ecosystem. Actors involved, relevant actor-related factors, and relations between actors in implementation projects

1.2.1.1 TECHNOLOGY

Although the technology has been chosen according to a set of requirements pre-established by the adopters ([Gallivan, 2001](#), [Leonard-Barton, 1988a](#), [Rogers, 2003](#)), there are always challenges to overcome throughout the implementation ([Leonard-Barton, 1988a](#), [Rogers, 2003](#)), and the characteristics of the technology will influence both the perceptions of the users and the expectations of the adopters.

The complexity of the technology is an important determinant of the complexity of the implementation project. There are two types of technology complexity: learning complexity and systemic complexity. Learning complexity is the degree to which a technology is perceived as difficult to understand and use ([Rogers, 2003](#)), in terms of the capabilities it requires to be used ([Berta et al., 2005](#), [Linton, 2002](#)). Capabilities are processes and routines rooted in knowledge ([Cepeda and Vera, 2007](#)). Therefore, the learning complexity is an indicator of the learning effort required during the implementation process.

Systemic complexity refers to the structure of the users that are integrated in a same system to use the technology ([Alin et al., 2013](#), [Barlow et al., 2006](#), [Fichman, 1992](#)). It defines the different operations that will have to be coordinated during the implementation, and whether or not a new structure is required for the adopter ([Barlow et al., 2006](#), [Fichman, 1992](#), [Leonard-Barton, 1988a](#)). These are not two independent characteristics of the technology, because the need for new capabilities might require the introduction of a new user or the transfer of processes, or tasks, from one user to another ([Edmondson et al., 2001](#)).

Furthermore, the technology's triability, compatibility, and flexibility may reduce its learning complexity, help users give meaning to the technology, and reduce the users' perceived uncertainty or risk about its use. Triability is the degree to which a technology may be experimented with, on a limited basis ([Rogers, 2003](#)). It might help increase the compatibility of the technology with the adopter, because experimenting with the technology may allow the identification of what should be modified towards the desired compatibility ([Rogers, 2003](#)). Moreover, experimentation with the technology, together with the demonstration of the technology's outcomes, may help users give more meaning to the technology by reducing the perceived complexity and risk of adoption ([Greenhalgh et al., 2004](#)).

Compatibility is the degree to which a technology is perceived as being consistent with the existing values and norms, past experiences, and needs of potential adopters ([Rogers, 2003](#)). The compatibility of the technology with the adopter's system defines the degree of readiness of the adopter to implement it, i.e., whether the adopter has the needed capabilities to use the technology ([Barlow et al., 2006](#), [Hausman et al., 2005](#), [Leonard-Barton, 1988a](#)). When communicated to users, compatibility may decrease the feeling of uncertainty about whether the technology will bring benefits ([Rogers, 2003](#)).

The technology might reveal more or less flexibility concerning the implementation ([Choi and Moon, 2013](#)). The flexibility of the technology is determined by its modularity.

1.2. Background and Key concepts

Modularity is the decomposition of the technology into smaller subsystems that can be managed independently although functioning together as a whole ([Baldwin and Clark, 1999](#), [de Blok et al., 2010](#)). Modular technologies allow planning the implementation in stages, dividing the overall risk of the project and reducing the perceived uncertainty among the users ([Linton, 2002](#)). Modularization makes the technology less difficult to learn, as it might be learned in stages, and allows for a better structured feedback for the technology provider, thus increasing the chances for reinvention, allowing the technology to become more compatible ([Leonard-Barton, 1988b](#)).

1.2.1.2 TECHNOLOGY PROVIDER

The technology provider may have an important role during the implementation process. It can provide a set of complementary services to support the implementation efforts, namely customization of the technology, training, and help desk services ([Greenhalgh et al., 2004](#)). These services can be used to make the technology more compatible with the adopter, increase the information that the users have about it, train the user capabilities required to use the technology, and support the overcoming of difficulties experienced during routinization efforts ([Leonard-Barton, 1988a](#)).

1.2.1.3 ADOPTER

There are five key characteristics of the adopter that contribute to define the implementation ecosystem: structure, technical setting, capacity, culture, and implementation strategy. These characteristics create the initial conditions for the implementation. The structure is defined by the number of units (organizations when the locus of adoption is a network, or departments or teams when the locus of adoption is an organization) involved in the implementation, their interactions, and the stability of those units and interactions over time.

Any implementation is expected to require changes in the operations of the units of the adopter to accommodate the technology, according to the scope of the implementation ([Leonard-Barton, 1988b](#)). Implementations with wider scopes are more complex, because each unit responds differently to the technology. Moreover, as units have different performance criteria and respond differently to their criteria, they also form different perceptions about the technology ([Leonard-Barton, 1988b](#)). However, implementations with wider scopes are also more likely to increase the adopter's technology readiness, because

more resources, and corresponding capabilities, are involved in the implementation ([Goes and Park, 1997](#), [Hausman et al., 2005](#), [Rogers, 2003](#)).

Existing interactions between units of the adopter define the structural holes within the adopter's structure, empowering some units that are more central ([Linton, 2002](#)), and limiting communication between them ([Rowley, 1997](#)).

Stability is the degree to which working teams change over time ([Barlow et al., 2006](#), [Edmondson et al., 2001](#)). Team stability benefits the learning process for a technology, although, if the team is stable for too long it may become tied in routines and more resistant to change ([Edmondson et al., 2001](#)).

The technical setting of the adopter refers to the business processes (rules and work practices), knowledge basis and consequent capabilities, and existing systems that define its readiness to incorporate the technology. In general, higher degrees of diversity and newness of the required technical setting correspond to higher complexities of the implementation ([Edmondson et al., 2001](#), [Linton, 2002](#)). The technical readiness of the adopter is also influenced by its maturity, i.e., prior experiences with similar technologies and implementations ([Berta et al., 2005](#), [Greenhalgh et al., 2004](#), [Hausman et al., 2005](#), [Leonard-Barton, 1988a](#)), because knowledge accumulates from previous experiences and learning efforts. Mature adopters also tend to be older, which may be a disadvantage in implementation projects, since they feature more deeply established routines that increase their resistance to change ([Salimath and Jones, 2011](#), [Sørensen and Stuart, 2000](#)). However, when the adopter is a network of organizations, mature organizations bring prestige to the networks that they integrate, especially to the parts that connect directly to them, which might be advantageous for implementations ([Oliver, 1990](#)), in particular if they support the new technology. These conflicting views indicate that maturity is a characteristic that should be regarded with caution ([Linton, 2002](#)).

Capacity refers to the resources (professionals and tangible assets) available in the adopter for the implementation project ([Meyers et al., 2012](#), [Power and Singh, 2007](#)). It is fundamental to make sure that adequate resources to use the technology and for support are available ([Meyers et al., 2012](#)). Specifically in networks of organizations, it is important to integrate the available resources and share asset specific investments among organizations of the network ([Power and Singh, 2007](#)).

1.2. Background and Key concepts

The culture and implementation strategy of the adopter will, naturally, strongly influence the implementation process and the perceptions of the users about the technology. The communication of implementation goals and purposes, and of the reasons behind implementation decisions, increases user motivation ([Greenhalgh et al., 2004](#)). Communication is also an important vehicle to promote participatory decision making related to the implementation ([Hausman et al., 2005](#)). Participation in decisions develops commitment among the users, increases their motivation, and helps internalize norms associated to the technology ([Leonard-Barton, 1988a](#)). Norms and funding help establish behaviour patterns for the units of the adopter ([Rogers, 2003](#)), which might encourage the assimilation of technologies. The presence of a champion for the technology during the implementation process helps overcome indifference or resistance to change ([Rogers, 2003](#)). The champion helps increase the motivation of users ([Rogers, 2003](#)) and facilitates relations and communication between the units of the adopter ([Hausman et al., 2005](#)), which, in turn, facilitates consensus on norms for the implementation process ([Rogers, 2003](#)).

1.2.1.4 USERS

The success of a technology implementation is achieved when users incorporate it in their operations, so that it becomes routinized ([Edmondson et al., 2001](#), [Greenhalgh et al., 2004](#)). The users, based on the information that they have about the technology, build perceptions about it, and motivation to use it ([Berta et al., 2005](#), [Edmondson et al., 2001](#), [Gallivan, 2001](#), [Greenhalgh et al., 2004](#), [Leonard-Barton, 1988a](#)). They have particular capabilities that enable them to adopt it, with lower or higher difficulty ([Berta et al., 2005](#), [Edmondson et al., 2001](#), [Gallivan, 2001](#), [Greenhalgh et al., 2004](#), [Leonard-Barton, 1988a](#)).

The motivation of users to use the technology is mostly affected by their perceptions ([Berta et al., 2005](#), [Greenhalgh et al., 2004](#)) and tolerance to uncertainty ([Furnham and Ribchester, 1995](#)). Their perceptions are mostly related to personal and global risk of adoption ([Greenhalgh et al., 2004](#)), specifically concerning the impact of the technology on their, and their unit's, activities, and the significance of those activities for their performance criteria ([Leonard-Barton, 1988a](#)). Moreover, the technology is perceived as difficult to use or complex to learn if the capabilities of the user are not aligned with the capabilities required ([Edmondson et al., 2001](#), [Linton, 2002](#)). However, the targeted users are expected to become more skilful and committed to the use of the technology throughout the implementation ([Klein and Sorra, 1996](#)). Perceptions and motivation change, and capabilities can be

developed, thus they should be carefully managed towards a successful implementation ([Klein and Sorra, 1996](#), [Linton, 2002](#)).

1.2.1.5 EXTERNAL CONTEXT

The external context of the implementation is relevant because of the influence that relations with external systems or networks have on the adopter ([Barlow et al., 2006](#), [Fichman, 1992](#), [Goes and Park, 1997](#), [Greenhalgh et al., 2004](#), [Linton, 2002](#), [Palinkas et al., 2014](#), [Rogers, 2003](#)). The more connected to others, i.e., the more cosmopolitan, the more an adopter is exposed to the influence of others ([Greenhalgh et al., 2004](#)). Decisions and perceptions might be a result of contamination from those external influences ([Berta et al., 2005](#), [Edmondson et al., 2001](#), [Rogers, 2003](#)).

In external systems that are networks of homophilous organizations ([Greenhalgh et al., 2004](#), [Rogers, 2003](#)), communication tends to be more effective and more rewarding. It increases knowledge, shapes attitudes, and changes behaviours ([Rogers, 2003](#)). Members of such a systems tend to follow established patterns ([Rogers, 2003](#)), or system norms ([Greenhalgh et al., 2004](#), [Palinkas et al., 2014](#), [Rogers, 2003](#)), that shape the tolerance of individuals to technologies ([Rogers, 2003](#)).

Besides external networks of relations, an overall responsible entity (such as a government) might take action to stimulate the implementation of a technology ([Berta et al., 2005](#), [Edmondson et al., 2001](#), [Fichman, 1992](#), [Greenhalgh et al., 2004](#), [Linton, 2002](#), [Palinkas et al., 2014](#), [Rogers, 2003](#)), creating rules or funding streams to foster its adoption ([Greenhalgh et al., 2004](#)) or increasing its perceived relative advantage ([Rogers, 2003](#)). Other factors tend to increase available financing and demand for technologies, such as the level of urbanization of the market environment with respect to the adopter's clients, the level of affluence to "acquire" the service offered by the adopter, and market competition ([Fichman, 1992](#), [Goes and Park, 1997](#), [Meyer and Goes, 1988](#)). These might also influence the perceptions about the value of the technology inside the adopter's structure ([Goes and Park, 1997](#)).

1.2.2 IMPLEMENTATIONS AS SEQUENCES OF ALIGNMENTS

The implementation is a transition period that might be what [Choi and Moon \(2013\)](#) designate a "mechanical implementation", when the technology is simple and requires no adaptations of the adopter or the technology, or a process of sequences of alignment ([Choi and Moon, 2013](#)), during which the adopter and the technology mutually adapt to fit each

1.2. Background and Key concepts

other ([Leonard-Barton, 1988a](#)). But this transition period might also be a period of strong inertia to change ([Edmondson et al., 2001](#), [Greenhalgh et al., 2004](#), [Leonard-Barton, 1988a](#)), which favours established routines ([Edmondson et al., 2001](#)). To overcome this inertia, capabilities and interdependencies are built and reconfigured during the implementation process ([Edmondson et al., 2001](#), [Goes and Park, 1997](#), [Klein and Sorra, 1996](#)). The dynamics of change will modify or create the adopter's structure, technical setting, and capacity, to bring them closer to those required to use the technology, as well as modify the technology to better suit the adopter ([Choi and Moon, 2013](#), [Leonard-Barton, 1988a](#), [Wei et al., 2005](#), [Wu et al., 2007](#)).

The implementation is defined based on the ability to resolve misalignments between the technology and its adopter ([Majchrzak et al., 2000](#)). Misalignments between a technology and the adopter result from a lack of compatibility between them ([Alin et al., 2013](#), [Choi and Moon, 2013](#), [Leonard-Barton, 1988a](#)), and emerge dynamically and unpredictably during an implementation process ([Wei et al., 2005](#)). They influence performance at different levels (network, organization, teams, and individual users) and meet with different evaluation criteria and perspectives about the implementation process at each of those levels ([Leonard-Barton, 1988a](#)) and throughout the implementation process ([Griffith, 1999](#)). Misalignments are thus the driver of change, or in other words, they are the need to align the technology and the adopters ([Leonard-Barton, 1988a](#)). Consequently, sequences of alignment efforts between the technology and the adopter take place during implementations ([Hanson et al., 2011](#), [Neubert et al., 2011](#)), which are difficult to plan and may have unforeseeable outcomes ([Wei et al., 2005](#)).

Alignment, which is studied in this thesis from an operational perspective, and not a strategic perspective, is a state that can be reached through an alignment process ([Hanson et al., 2011](#)). As mentioned above, it can be achieved in implementation projects through efforts of change in the technology and in its adopter, with the objective of increasing the compatibility between them. These alignment efforts are expected to require adaptations in the structure, technical setting, and capacity of the adopter and in the structure and functionalities of the technology ([Power and Singh, 2007](#), [Shaw and Holland, 2010](#), [Dominguez-Péry et al., 2013](#), [Meyers et al., 2012](#)). The impacts of misalignments throughout the implementation process are assessed using the adopter's performance criteria, and according to that assessment the adopter's structure, technical setting and capacity are modified or created to bring them close to those required for an efficient use of the technology. Similarly, changes in the learning and

systemic complexities of the technology are promoted to better suit it to the adopter's context of operations, namely by changing its functionalities and the structure of interactions between its modules.

These dynamics of alignment will reduce the lack of compatibility between the technology and the adopter, following the principle of mutual adaptation cycles ([Leonard-Barton, 1988a](#)) or sequences of alignment ([Alin et al., 2013](#), [Neubert et al., 2011](#)). Such sequences may be initiated by implementation managers ([Basoglu et al., 2007](#), [Wei et al., 2005](#)) or may occur naturally, triggered by the natural evolution of the implementation project ([Choi and Moon, 2013](#), [Darbanhosseiniamirkhiz and Wan Ismail, 2012](#)).

1.2.3 IMPLEMENTATIONS AND NETWORKS

[Linton \(2002\)](#) suggests the use of networks as units of analysis for implementation studies. Independently of the locus of adoption (individual, organization, or network of organizations), using a network as the unit of analysis is argued to represent more accurately the reality that implementation managers face, since it will allow studying implementation processes at multiple levels simultaneously, and consider the various roles that influence the implementation outcome ([Linton, 2002](#)). Networks tend to be used to represent: the relations of a specific member, i.e., ego-centred networks, which are centred in the member of particular importance for the purpose of the study; or the relations of a set of members in which no member is of particular importance for the purpose of the study, and it is imperative to consider all the relations between the members of the entire network, called web network ([Borgatti et al., 2009](#), [Linton, 2002](#)).

Networks centralized in one organization, hub-and-spoke networks, are the appropriate structure to analyse implementations that take place in the central organization of the network, then focusing the analysis on the relations between the organizations in the network and not on the network structure ([Linton, 2002](#)). This approach uses a perspective closer to the institutional theory perspective, with special attention to influences between organizations and to the types of relationships between them ([Goes and Park, 1997](#), [Linton, 2002](#)). In this approach, it is clearly more important to consider factors regarding relations between organizations than regarding the structure of the network ([Linton, 2002](#)).

On the other hand, the most appropriate approach to study implementations in more than one organization, is the web network approach ([Linton, 2002](#)). In this case it becomes more

1.2. Background and Key concepts

important to consider the structure of the network than the type of relations between its members ([Hausman et al., 2005](#), [Linton, 2002](#), [Palinkas et al., 2014](#), [Taylor, 2005](#)), because, depending on the characteristics of the technology, the network as a whole will enable or hinder the success of the implementation ([Linton, 2002](#)). These scenarios of implementation become more complex because the structure of the network depends on organizational characteristics that enhance some structures and hinder others ([Linton, 2002](#)).

When the adopter of the technology is a single organization, misalignments are resolved internally, by the organization's management structure or by negotiating with the provider of the technology ([Ansari et al., 2010](#), [Basoglu et al., 2007](#), [Choi and Moon, 2013](#), [Edmondson et al., 2001](#), [Greenhalgh et al., 2004](#), [Leonard-Barton, 1988a](#), [Rogers, 2003](#), [Wei et al., 2005](#)). However, when the adopter is a network of organizations, alignment efforts have to be frequently negotiated between members of the network ([Harty, 2005](#), [Hellström et al., 2011](#), [Hinkka et al., 2013](#), [Kurnia and Johnston, 2000](#), [Lee et al., 2005](#)), which have independent power structures that require orchestration of decisions ([Dhanarag and Parkhe, 2006](#), [Goes and Park, 1997](#)) making the decision process more complex.

The alignment between the network and the technology therefore results from negotiations among the organizations of the network, concerning their different perspectives about the implementation project ([Harty, 2005](#), [Hinkka et al., 2013](#), [Kurnia and Johnston, 2000](#), [Shin, 2006](#)), toward a consensus, expected to influence positively the outcome of the implementation ([Hausman et al., 2005](#)). Those negotiations start at the adoption decision stage, and must include all the participants in the implementation (organizations of the network) in order to increase the implementation planning capability ([Lee et al., 2005](#)). Negotiations must guarantee that resources, motivations, implementation plans and goals are aligned among the organizations towards an improved implementation outcome ([Cagliano et al., 2005](#), [Dominguez-Péry et al., 2013](#), [Hinkka et al., 2013](#), [Wakerman et al., 2005](#)), as well as that the proper network structure is in place to implement the technology ([Kurnia and Johnston, 2000](#)).

Alignment efforts can be led by a single organization of the network (a proactive adopter of the technology), working as a focal firm in the implementation process ([Chan and Swatman, 2000](#), [Ramamurthy et al., 1999](#)). In that case, the focal firm must have the necessary expertise to help its partners implementing the technology, because only when all the network partners fully integrate the technology in their operations will the whole network benefit from the

implementation and experience increased performance ([Ramamurthy et al., 1999](#), [Setia et al., 2008](#)). Alternatively, several, or even all, the organizations of the network, can lead the alignment efforts. In this case, the organizations suggest adaptations in the technology ([Cagliano et al., 2005](#)) or in the network ([Alin et al., 2013](#)), inspired by their ongoing learning about how to use the technology ([Alin et al., 2013](#), [Cagliano et al., 2005](#)) and how to relate with each other ([Cagliano et al., 2005](#)). This makes implementations of technologies in networks of organizations particularly complex scenarios of implementation.

Implementations of technologies in networks are a particularly relevant topic of research for networks of preventive healthcare organizations, which are independent organizations whose operations depend on each other, and have to be able to operate as a network and use technologies collaboratively to provide adequate care to their patients.

1.3 RESEARCH OBJECTIVES AND METHODOLOGY

This thesis is motivated by the importance of implementations of technologies in networks of preventive healthcare providers, for the adopters to routinize and assimilate the technologies and fully benefit from them. The focus of the research is on the implementation process, using a perspective that looks at those processes as sequences of alignment between the technology and the adopter ([Alin et al., 2013](#), [Choi and Moon, 2013](#), [Leonard-Barton, 1988a](#), [Neubert et al., 2011](#)). The main goal of the thesis is to improve the current understanding about such implementations, and the dynamics and influences that take place during sequences of alignment. The research question related to this main objective is the same as the first research question of Chapter 2: “How are technology and adopters aligned when an implementation takes place in a network of organizations?”

To address this question, and since no review about this topic was found in the literature, the main goals of a first part of this research, Chapter 2, were to understand what was known in the management research literature about (a) the efforts to align technology and its adopters in implementations when they take place in networks of organizations, and (b) the management interventions associated with handling misalignments and controlling the alignment process. Two review questions, thus, were proposed:

- RQ1: “How are technology and adopters aligned when an implementation takes place in a network of organizations?”

1.3. Research objectives and Methodology

- RQ2: “How is this alignment managed?”

A systematic literature review ([Rousseau et al., 2008](#), [Tranfield et al., 2003](#)) was performed to address these questions and establish an appropriate knowledge basis for the remaining work. The review provided a systematization of the existing knowledge about the topic and some directions for future research, which in part usefully framed the scientific and practical relevance of the other two chapters.

Two challenges were identified. First, it was found that in the literature authors have used different classification schemes, or have not used them at all, to classify misalignments and alignment efforts. This condition creates a lack of a structured way to systematize the presentation of findings concerning sequences of alignment during implementation projects. Consequently, it becomes difficult to compare findings from different studies in the literature and to build knowledge based on previous research. The identified gap inhibits the systematization of knowledge about misalignments and alignment efforts, and can be translated into the following research question: “How can misalignments and efforts of alignment between technologies and their adopters during implementations be classified?”. In order to answer that question and fill the corresponding gap, two classification schemes are proposed in Chapter 3, one to classify misalignments and the other to classify alignment efforts, in implementations of technologies.

Second, the findings from the review revealed that relations between classes of misalignments and alignment efforts are not always linear, in the sense that a misalignment of one class does not necessarily lead to an alignment effort of the same class. Furthermore, they also revealed that alignment efforts to solve one misalignment may trigger new misalignments and further alignment efforts. These are two important mechanisms for implementation processes, because they open possibilities for overcoming the different misalignments faced in implementations, and because they reveal that the proposed classes are interconnected. It is thus important to expand the understanding about sequences of alignment beyond the most obvious and linear sequences in which a misalignment of one class triggers an alignment effort of the same class. To define this second challenge and guide the research work the following questions were proposed:

- RQ1: “How do non-linear and cascading sequences of alignment between a technology and a network of organizations arise during implementation projects?”

- RQ2: “What are the consequences of non-linear and cascading sequences of alignment in the implementation process?”
- RQ3: “How are non-linear and cascading sequences of alignment managed during implementations of technologies in networks of organizations?”

The findings from the review also made clear that this stream of research is undergoing a significant evolution. With this in mind, and because the focus of the research was the study of processes of adaptation, qualitative research was used ([Easterby-Smith et al., 2012](#)). To explore the research questions, an inductive multiple case research about implementations of a new health screening program in several networks of healthcare providers located in the North of Portugal was conducted. The screening program, which since 2009 has gradually been implemented in the North of Portugal, by the Regional Health Authority (RHA), was considered an appropriate setting for these studies because it is provided by networks of healthcare organizations and uses a set of technologies that support its operations, and because it is an important screening procedure that must be performed by all diabetic patient on an yearly basis ([WHO, 2006](#)), which ensures its continuity.

As case research allows rich, in depth empirical descriptions, and is based on a variety of data sources, it provides a suitable research design for examining and clarifying the type of complex processes that are face in this research ([Yin, 2009](#)). The research design was embedded because there were multiple levels of analysis ([Eisenhardt, 1989](#)). The primary unit of analysis was the implementation project of the screening program in one network of healthcare providers and the embedded units of analysis were: the network of healthcare providers, the healthcare provider organizations, and the technology being implemented. Moreover, using diversified case studies and a solid literature support, we were able to gather insightful scientific data to analyse, and constructs to extract, as suggested by [Eisenhardt \(1989\)](#). The triangulation of the multiple sources of evidence, namely semi-structured interviews, archival documents and statistical data, provided credibility and strengthened our results ([Corbin and Strauss, 2015](#), [Eisenhardt, 1989](#), [Yin, 2009](#)). We explored data iteratively, going back and forth between the qualitative data and theoretical arguments ([Corbin and Strauss, 2015](#)). The analyses were divided in two stages: (1) within case analysis, selecting and organizing the relevant data and searching for within case patterns, and (2) cross-case analysis, searching for cross-case patterns ([Eisenhardt, 1989](#)).

1.4 THESIS OUTLINE

The previous section has already indicated that Chapter 2 establishes the knowledge basis to frame the other two chapters, and that Chapter 3 offers classification schemes that are used in Chapter 4. Figure 1.2 depicts these relations between the chapters.

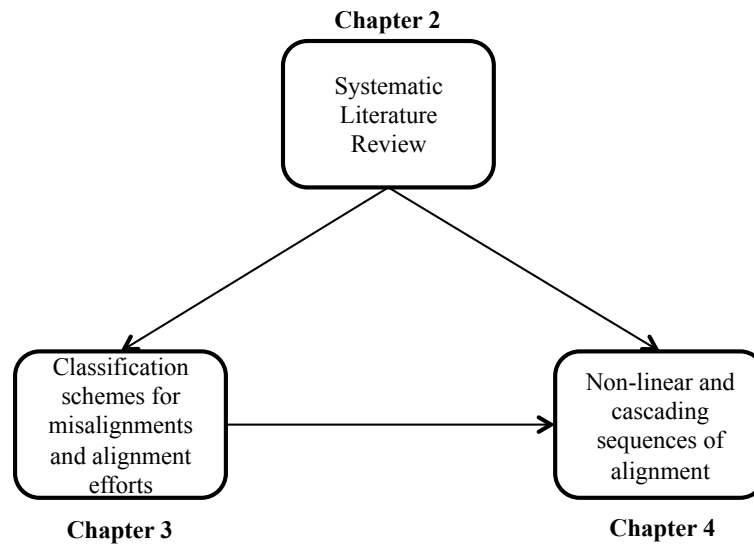


Figure 1.2 – Chapters of the thesis

The thesis is composed of three original research papers, corresponding to each of the three chapters. Despite the many advantages of this approach, it has the drawback of resulting in multiple identical descriptions of the same phenomena and repeated definitions of the same constructs. In this section, we provide an overview of each chapter, highlighting the most substantial contributions of each.

Chapter 2 offers a systematic literature review about the efforts to align technology and its adopters during implementations in networks of organizations. Based on the review, this chapter contributes to the upcoming and emerging research about this topic by providing a thorough aggregation of the findings so far. A conceptual framework is built to guide future research, namely by interrelating the constructs involved in the topic, and a collection of promising future research directions is provided, some resulting from the review and others suggested in the literature.

Chapter 3 presents two classification schemes, one to classify misalignments and the other to classify alignment efforts, proposing a structured way to systematize operational alignment challenges in implementations of technologies. Such classifications increase the

comparability of results from different studies, which in the future will facilitate the creation of new knowledge based on prior findings. Directions for future research are also provided.

Chapter 4 contributes to the understanding of how non-linear and cascading sequences of alignment arise, how they are managed, and what their consequences are, during implementations of technologies. Non-linear and cascading sequences of alignment appear to be important mechanisms throughout implementations of technologies in networks of organizations. The findings provide a rich picture of the challenges of implementation management in networks of organizations, namely concerning non-linear and cascading sequences of alignment, which are frequently part of the same sequence of alignment. The chapter also provides directions for future research.

Finally, Chapter 5 summarizes the thesis, compiles the conclusions of the three main chapters, and suggests directions for future research.

1.4. Thesis outline

2 ALIGNING TECHNOLOGIES AND NETWORKS IN IMPLEMENTATION PROJECTS: A SYSTEMATIC LITERATURE REVIEW

José Coelho Rodrigues^{*†} · João Claro^{*†} · Ana Cristina Barros[†]

ABSTRACT

This paper systematizes the current understanding in the literature about efforts to align technology and adopters in implementations that take place in interorganizational networks. For several decades, researchers have already been conceptualizing implementations as processes of mutual adaptation, or alignment, but only recently has an interest on interorganizational networks as a locus of adoption started to develop. Nevertheless, the volume of existing relevant literature already justifies a review, especially considering that research on this topic is significantly scattered across journals and disciplines.

Findings from a systematic literature review contribute to conceptualize alignment efforts in implementations taking place in networks and understand their impact on the implementation outcome. The review shows that knowledge about alignment management is still scarce and weakly supported, and provides directions for future research, supported by a conceptual framework, which also offers useful guidance for practitioners.

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2.1 INTRODUCTION

Networks of organizations are systems of complementary products or services provided by different organizations, and are becoming widespread and coming to play increasingly important roles in contemporary economies ([Alin et al., 2013](#), [Hayes, 2005](#)). Their operations often involve the use of technological solutions, in particular to support the interactions between the organizations. For example, to support collaborative business operations, networks of organizations have been implementing technological innovations such as electronic data interchange (EDI), radio frequency identification (RFID) ([Bhattacharya, 2012](#), [Cegielski et al., 2012](#), [Chwelos et al., 2001](#), [Croteau and Bergeron, 2009](#)), collaborative R&D software platforms ([Cunha et al., 2007](#), [Grethe et al., 2005](#)), electronic health records, or evidence-based practices ([Aarons et al., 2011](#), [Barlow et al., 2006](#), [Palinkas et al., 2014](#), [Sicotte et al., 2006](#)).

For the purpose of this study, technological innovations, hereafter referred to simply as “technologies”, are understood as “a body of knowledge, tools and techniques, derived from science and practical experience, that is used in the development, design, production, and application of products, processes, systems, and services” ([Abetti, 1989](#), [Buganza et al., 2015](#), [Steensma and Corley, 2001](#)). The full realization of the potential of technologies requires a good understanding of their implementation processes, which are critical for a successful assimilation in the routine operations of the adopter ([Edmondson et al., 2001](#), [Rogers, 2003](#)), in this case a network of organizations. Implementations include the activities between the decision to adopt and the incorporation of the technology in the routine operations of the adopter, or its abandonment. These activities are typically grouped in three main stages: adoption decision, implementation, and assimilation (or other final outcome of the implementation) ([Rogers, 2003](#), [Greenhalgh et al., 2004](#)).

Networks are organizational groups with close, robust and multidimensional ties, that blur hierarchical boundaries ([Baum and Ingram, 2002](#)). They are challenging settings for operations, because they typically feature complex behaviours, which arise from the mutual dependence between independent power structures that jointly seek to provide a product or service ([Hayes, 2005](#)). Managing implementations in such semi-dependent structures is thus also challenging, requiring the orchestration of the decisions of multiple organizations ([Dhanarag and Parkhe, 2006](#), [Goes and Park, 1997](#)) against a backdrop of network evolution

2. Aligning technologies and networks in implementation projects: A systematic literature review

dynamics that depend not only on the individual organizations, but also on their mutual alignment ([Hung et al., 2011](#), [Taylor, 2005](#)).

Additionally, like in other implementation loci, networks implementations also see initial losses of productivity, due to misalignments that may exist between the technology and the adopting network ([Basoglu et al., 2007](#), [Leonard-Barton, 1988a](#), [Wei et al., 2005](#), [Wu et al., 2007](#)), resulting from a lack of compatibility between them ([Alin et al., 2013](#), [Choi and Moon, 2013](#), [Leonard-Barton, 1988a](#)). Misalignments influence performance at different levels (network, organizations, teams, and individuals), and at each level meet different evaluation criteria and perspectives on the implementation process ([Leonard-Barton, 1988a](#)).

Misalignments usually lead to a dynamic sequence of mutual adaptations in the structures and capabilities of the technology and the network, throughout the implementation ([Alin et al., 2013](#), [Choi and Moon, 2013](#), [Leonard-Barton, 1988a](#), [Wei et al., 2005](#)). Mutual adaptations, or sequences of alignment efforts, simultaneously influence and are influenced by management interventions (decisions and actions) and are a major challenge in implementations ([Bhattacharya, 2012](#)).

Alignment can be defined as a state with associated desired goals, which can be achieved through a process that influences the performance of the targeted organization(s) ([Hanson et al., 2011](#)). This review is focused on the type of alignment called “internal” alignment ([Henderson and Venkatraman, 1993](#), [Pinheiro, 2013](#)), which concerns choices related to the design and redesign of structures, business processes and functionalities, and the acquisition and development of the resources required to achieve the desired outcome, i.e., the state of alignment ([Henderson and Venkatraman, 1993](#)). In this context, alignment efforts are the operational results of those choices and the alignment process is the sequence of alignment efforts that take place until the alignment state is achieved.

Although research on alignment efforts in network implementations has been scarce ([Alin et al., 2013](#)), its volume and high level of dispersion across journals and disciplines, combined, justify a systematic literature review. The main goal of this review is to understand what is known in the management research literature about (a) the efforts to align technology and its adopters in implementations when they take place in networks of organizations, and (b) the management interventions associated with handling misalignments and controlling the alignment process. Two review questions, thus, are proposed:

2.2. Method

RQ1: “How are technology and adopters aligned when an implementation takes place in a network of organizations?”

RQ2: “How is this alignment managed?”

We have, therefore, a particular interest in research findings related, at one level, to the alignment efforts that are carried out to overcome misalignments, and their combination in alignment processes, and at another level, to the management of alignment efforts and processes, namely the concerns and interventions of managers to design or redesign structures, technical capabilities and business processes during implementations in networks of organizations.

As no reviews on this topic have been found in the literature, this systematic review is a valuable contribution for upcoming and emerging related research, providing a thorough aggregation of the findings published so far, and more specifically a synthesized conceptual framework and future research recommendations.

This paper is structured as follows. In the following section the systematic literature review method is explained in detail. The results are then presented in the two subsequent sections: first, the papers included in the review are characterized generically; second, we report the relevant findings related to alignment efforts, process and management, and propose a conceptual framework based on those findings, which systematizes and summarizes the knowledge retrieved from the literature. The findings of the review are then discussed, and resulting future research directions are proposed. The paper closes with a summary of the main contributions of this study for the research community and for practitioners.

2.2 METHOD

With the objective of synthesizing the current knowledge on how to manage the alignment of technologies and adopters during implementations in networks of organizations, we carried out a systematic literature review, following the procedures suggested by [Tranfield et al. \(2003\)](#), [Rousseau et al. \(2008\)](#), and [Briner and Denyer \(2012\)](#).

The systematic literature review is a replicable, systemic, scientific and transparent method, which addresses specific questions, and seeks to minimize biases by means of exhaustive literature searches and by “providing an audit trail of the reviewers decisions, procedures and

conclusions” ([Tranfield et al., 2003](#)). With this purpose, we provide in this section a detailed description of our review process.

2.2.1 REVIEW PROTOCOL

Initially, as suggested by [Briner and Denyer \(2012\)](#), we developed and documented our review protocol, which included: (a) background and motivation for the literature review, (b) its objective, (c) research (or review) questions, (d) search strategy, (e) paper selection process, (f) procedures for data analysis, including the assessment of methodological quality, and (g) procedures for the synthesis of findings. The first three parts (a-c) have been presented in the introduction section, the remaining parts (d-g) are presented in this section, and the findings of the review are presented in the two following sections. This protocol served as a plan and a guide for the research.

2.2.2 SEARCH STRATEGY

The search was focused on journal articles and review papers whose titles, abstracts, or keywords included a combination of the following search terms: (implement* OR adopt* OR assimil*) AND (fit* OR align* OR match* OR adapt* OR misfit* OR misalign* OR mismatch*) AND (network* OR interorganizat* OR interorganisat* OR inter-organ*). The asterisk (*) ensures that all words beginning with the part that precedes it are included in the search. For instance, “implement*” will ensure the inclusion of terms such as “implementation”, “implemented”, “implementing”, or “implement”. To define the terms to be included we carried out general analyses of the management literature on implementations of technologies, implementations in networks of organizations, and alignment. The terms related to alignment showed the least consensus in the literature, and were thus the hardest to define. Nevertheless, we looked for studies that used the definition of alignment introduced in the previous section, and were able to narrow down the list of terms to alignment, fit, match and adaptation, their opposites (misfit, misalignment, mismatch), and their other forms (such as aligning, matching and adapt). For further validation, these terms were confirmed by two experts with relevant published work in the field, specifically focusing on alignment.

The papers (journal articles and reviews) were collected from two databases: Scopus (<http://www.scopus.com/>) and Web of Science (<http://apps.webofknowledge.com/>). The search was limited to papers written in English, included in journals or conference proceedings, in the research fields of business economics, business management, and

2.2. Method

management science, and published until 2013. 1976 was the earliest year of publication found. The searches were performed in September 2014.

2.2.3 SELECTION OF PAPERS FOR REVIEW

A total of 1290 papers were retrieved from the search. Our use of different databases, which feature some journal overlap, led to the presence of duplicates (identified by title comparison), whose exclusion left us with 1107 papers. These were then analysed by a team of three researchers for a match with inclusion and exclusion criteria, in a selection process that was carried out in four stages, as showed in Table 2.1.

Stage	Data analysed	Inclusion / Exclusion criteria	Number of papers selected
1	Titles of 1107 papers retrieved in database search	Include: <ul style="list-style-type: none">• Papers focusing on alignment during implementations in networks of organizations• Papers whose title is not clear about what is being studied. Exclude: <ul style="list-style-type: none">• Papers whose title explicitly mentions a research focus different from implementation or alignment, such as:<ul style="list-style-type: none">◦ Optimization models, optimization or software algorithms, simulation studies◦ Methodologies for software or product development◦ Development of other types of methodologies unrelated to alignment◦ Strategy evaluations◦ Business models◦ Specific conceptual frameworks addressing problems unrelated to implementation or alignment◦ Reviews of other fields of research such as human resources.	450
2	Abstracts of 450 papers selected in stage 1	Exclude: <ul style="list-style-type: none">• Papers whose focus is clearly not implementation• Papers that clearly focus on policy implementations, instead of technology implementations• Papers that do not address operations of the organizations• Papers that clearly focus on implementations, but not on a network of organizations as the adopter.	30
3	Full text of 30 papers selected in stage 2	Exclude: <ul style="list-style-type: none">• Papers that do not focus on implementations in networks of organizations• Papers that do not consider questions about alignment.	27
4	The literature discussions in the 27 papers selected in stage 3 were carefully scrutinized to find references to other studies of alignment during implementations in networks of organizations. This final stage of selection was extremely important to address initial limitations in the search, namely the fact that it started by being confined to the Scopus and Web of Science databases, and to the fields of business economics, business management, and management science. In fact, implementation of technologies is an interdisciplinary topic, with relevant publications coming out also in technical journals, and other publications are not so well indexed in the databases. An additional 17 papers were retrieved, of which 14 were included in the review after detailed reading.		41

Table 2.1– Paper selection process

Three researchers performed the first two stages of the selection procedure (one of the three authors screened all the papers, and each of the other two screened half). The third stage was performed by two of the three authors. At each stage, after screening the papers the three researchers met to discuss and resolve judgement discrepancies.

2.2.4 DATA ANALYSIS

The 41 papers selected for review were analysed in terms of: the implementation process, the technology and the adopter; alignment aspects, such as definition, efforts, measurement, and management tools, among others; management aspects, such as interventions, concerns, and capabilities, among others; evidence of gaps not yet addressed in the literature and suggestions of future research directions. This process was performed by coding the text of the papers using structural and simultaneous coding ([Saldana, 2012](#)). The relevant segments of data were coded using appropriate qualitative analysis software, relating them to specific themes. The coding allowed a later comparison of the segments to investigate commonalities, differences, and relationships, for the analysis of specific topics ([Saldana, 2012](#)). The list of codes used in the structured coding is presented in Table 2.2. The coding was also simultaneous, to allow for the possibility of a segment of data being relevant for two or more codes, for instance, “Alignment Process” and “Implementation Process”.

Codes	Number of segments coded
Adopter	71
Alignment Process	443
Future Research	116
Implementation Outcome	133
Implementation Process	748
Limitations of Research	56
Method	517
Object of Study	141
References (additional papers)	38
Technology	91
Unit of Analysis	13

Table 2.2 – List of codes used in data analysis and number of segments coded

During the coding, additional summaries of each paper were produced and included in a spreadsheet table, capturing the most important data for the synthesis of the findings. The table included the following fields: reference of the paper, number of additional references collected from the paper, method used, methodological quality, objective of the paper, summary of alignment issues considered and theories used, future research directions proposed, technology, adopter, industries, and countries where the study was performed. The synthesis was carried out using the data collected in this table, and with the support of the segments of text coded in each paper.

Regarding methodological quality, all the studies included in this review come from peer-reviewed publications, almost all indexed in reliable databases (Scopus and Web of Science) and thus are a priori expected to be of good quality. This was confirmed by the authors, who used, for this purpose, the checklists proposed by [Briner and Denyer \(2012\)](#), adopting the principle that any research design can provide good quality data for this study, as long as it

2.3. *General characteristics of the reviewed studies*

follows the best scientific standards, guaranteeing validity and reliability, and drawing conclusions that are strongly supported on data.

2.2.5 SYNTHESIS OF FINDINGS

The synthesis of the findings was performed using interpretation ([Rousseau et al., 2008](#)) together with narrative synthesis ([Briner and Denyer, 2012](#)), because it was driven by interest in a social phenomenon (alignment in implementation projects, and its management) and most of the studies included in the review were qualitative, with primary data not accessible except in published form.

The purpose of the synthesis was to identify higher order concepts and to provide a larger narrative and generalizable theory on the management of alignment in implementation projects taking place in interorganizational networks. That purpose was achieved by compiling, conceptualizing and reinterpreting the descriptive data, while preserving its original integrity and wholeness ([Rousseau et al., 2008](#)). Throughout the effort of synthesis, data quality was pursued by triangulating the findings of the papers.

In the following two sections, we provide a characterization of the papers included in the review, and subsequently present the findings of the review, using a conceptual framework derived from the findings, with additional support of diverse tables and graphics.

2.3 GENERAL CHARACTERISTICS OF THE REVIEWED STUDIES

We considered 41 papers (see bottom row of Table 2.1) for the analysis and the synthesis of findings. They were published between 1994 and 2013, with the time distribution presented in Figure 2.1. The annual number of publications is variable, and is not suggestive of a clearly growing interest in the topic. The majority of the papers, however, were published since 2005, and the four years with more publications were 2005 (7), 2007 (5), 2011 (4), and 2013 (6), suggesting that the interest is indeed higher in more recent literature, although not continually increasing. The higher number of publications since 2005 may be in part the result of a shift in the focus of the alignment literature, dating back to the early 2000's, from a static understanding of causal relations between characteristics of alignment and implementation performance, to the identification of the mechanisms and dynamics of the alignment process that may explain observed changes and adaptations ([Street, 2007](#)). This shift may have set the stage for an increase in the interest on the alignment process from the

2. Aligning technologies and networks in implementation projects: A systematic literature review

implementation literature. The high variability in the annual number of publications should mostly be related to the small number of annual publications.

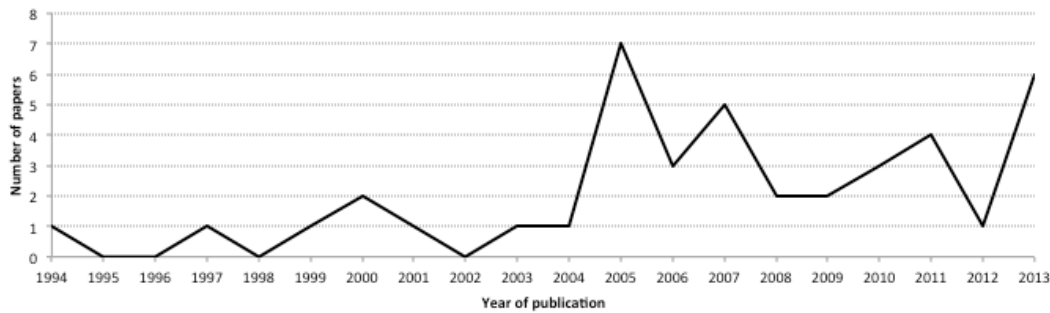


Figure 2.1 – Time distribution of the papers included in the review

As shown in Figure 2.2, most of the reviewed papers use case study research, suggesting that the research on this topic is still at an early stage and is mostly exploratory.



Figure 2.2 – Research methods used in the studies included in the review

The papers included in this review have been published in 33 journals, belonging to a wide variety of disciplines, which confirms the interdisciplinary nature of the topic. Only six journals have more than one paper included in the review, and none have more than 3. The journal distribution is presented in Table 2.3.

Most of the studies included in the review analyse implementations of Information Systems (IS), mostly internet-based systems (such as Enterprise Resource Planning (ERP) systems, Vendor Managed Inventory (VMI) systems or similar), general inter-organizational information systems (IOIS), RFID, EDI, and computer aided design (CAD) systems. Figure 2.3 presents the distribution of the types of technologies analysed. The few implementations of new work processes take place in the healthcare (2) and the aerospace (1) industries. The types of adopters are operations or project networks (supply chains – 29, project networks –

2.3. General characteristics of the reviewed studies

9, and general networks – 2), except for one paper in which the adopter is a network encompassing a whole industry.

Journal	Number of papers
International Journal of Operations & Production Management	3
Internet Research	3
Industrial Management & Data Systems	2
Journal of Operations Management	2
Journal of Strategic Information Systems	2
Project Management Journal	2
Advanced Engineering Informatics	1
Benchmarking: An International Journal	1
Building Research & Information	1
Decision Support Systems	1
Electronic Markets	1
IEEE Transactions on Engineering Management	1
Industrial Marketing Management	1
Information Systems and e-Business Management	1
Information Technology & Management	1
International Journal of Accounting Information Systems	1
International Journal of Computer Integrated Manufacturing	1
International Journal of Information Systems and Supply Chain Management	1
International Journal of Integrated Supply Management	1
International Journal of IT Standards and Standardization Research	1
International Journal of Physical Distribution & Logistics Management	1
International Journal of Procurement Management	1
International Journal of Production Economics	1
Journal of Business & Industrial Marketing	1
Journal of Management Information Systems	1
Journal of Organizational Computing and Electronic Commerce	1
Journal of Supply Chain Management	1
Journal of Technology Management and Technology	1
Management Decision	1
Medical Journal of Australia	1
Organization Science	1
Problems and Perspectives in Management	1
Production Planning & Control	1

Table 2.3 – Number of papers included in this review per journal

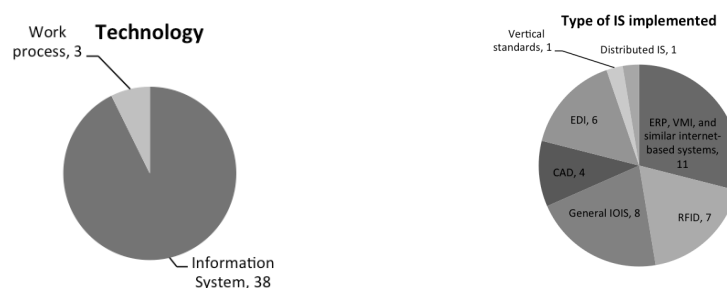


Figure 2.3 – Number of papers analysing implementations of information systems and new work processes (left); Distribution of types of information systems implemented (right)

Multiple industries have been studied, as can be seen in Figure 2.4 (left), with most of the papers considering one specific industry (29), but several others including a cross industry assessment (10), and only a few theoretical studies not addressing a target industry (2). The latter are two literature reviews proposing conceptual frameworks. The studies are mostly carried out in Australia, Europe, North America, and Asia, with a very spread distribution,

2. Aligning technologies and networks in implementation projects: A systematic literature review

clearly visible in Figure 2.4 (right). The studies that do not consider a specific country are mostly theoretical, but the group also includes some qualitative studies.

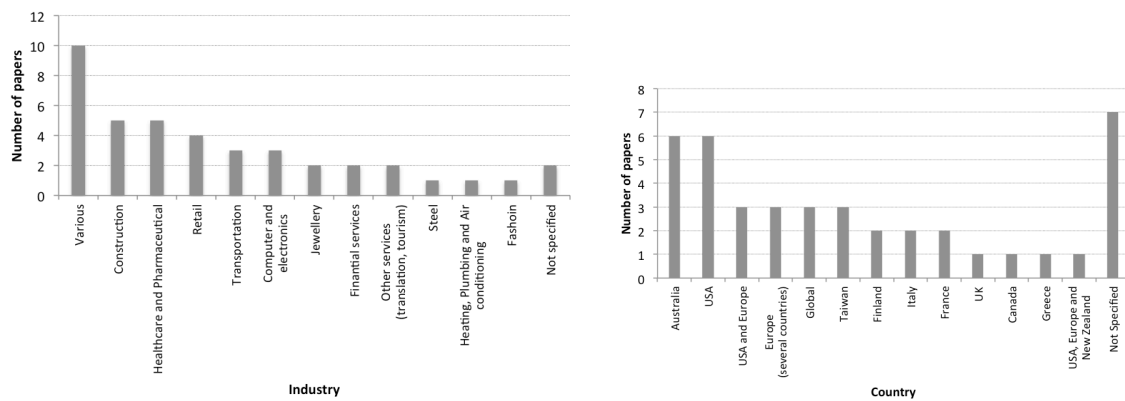


Figure 2.4 – Industry (left) and country (right) distributions of reviewed papers

Regarding the focus of the papers, only six have alignment as their primary focus, as shown in Table 2.4. The remaining 35 papers have as main focus the implementation process (31), the development of a technology in the context of the adopter (3), and the development of new network structures (1). We separate the development of a technology in the context of the adopter from the implementation process, because the process itself is different, and because the papers that address the former study adopters that simultaneously are innovators. After a detailed analysis of the papers, however, it became clear that the alignment issues and efforts are the same as in studies of implementations, and they were kept in the review. Although not focusing on implementation, the paper on the development of new network structures considers alignment issues in the formation of these structures, and thus also fits the scope of the review.

The 35 papers with alternative primary foci nonetheless feature important contributions to the topic of alignment, and recognize alignment as an important issue in the implementation process. Together with the fact that the six papers with primary focus on alignment have been published recently (2007 – 1, 2010 – 1, 2011 – 2, 2013 – 2), this is suggestive of the topic's increasing importance and interest.

2.3. General characteristics of the reviewed studies

Focus on alignment	Number of papers	Papers
Main focus of the paper	6	Alin et al. (2013) , Dominguez-Péry et al. (2013) , Hellström et al. (2011) , Neubert et al. (2011) , Taylor and Levitt (2007) , Thun (2010)
Secondary focus of the paper	35	
Main focus on the implementation process	31	Angeles (2008) , Chae et al. (2005) , Chan and Swatman (2000) , Croom (2001) , Danese et al. (2006) , Devaraj et al. (2007) , Fosso Wamba et al. (2007) , Gharavi et al. (2004) , Hadaya (2009) , Hartmann et al. (2009) , Harty (2005) , Hausman et al. (2005) , Henderson et al. (2012) , Hinkka et al. (2013) , Hung et al. (2011) , Kurnia and Johnston (2000) , Lee et al. (2005) , Loebbecke (2007) , Mendoza and Ravichandran (2011) , Power and Singh (2007) , Premkumar et al. (1994) , Rajaguru and Matanda (2013) , Ramamurthy et al. (1999) , Rivera and Rogers (2006) , Segev et al. (2003) , Setia et al. (2008) , Shaik and Abdul-Kader (2013) , Shin (2006) , Sigala (2013) , Tan et al. (2010) , Wakerman et al. (2005)
Main focus on the development of technology	3	Cagliano et al. (2005) , Croom (2005) , Shaw and Holland (2010)
Main focus on development of new network structures	1	Holland and Lockett (1997) ,

Table 2.4 – Main foci of the reviewed papers

Within implementation, the reviewed references can focus on any of its three stages: adoption decision, implementation, or assimilation. Implementations were initially studied in the scope of individual adoption ([Rogers, 2003](#)), and for that reason a long tradition exists in the literature of focusing on the adoption decision. The implementation and assimilation stages only started to acquire importance when researchers started to study implementations in organizations, where adoption is usually the responsibility of a group of decision makers, and the technology is then used by a different group, typically operational staff, requiring a process to create awareness and to foster the usage of the innovation ([Greenhalgh et al., 2004](#), [Leonard-Barton, 1988a](#), [Rogers, 2003](#)).

The papers included in this review address mostly only the implementation and/or the assimilation stages (22), some only the adoption decision stage (12), and only a few the three stages (7), as shown in Table 2.5. The implementation and assimilation stages are often studied together because assimilation is the outcome of implementation. We consider the papers focused on the development of a technology in the adopter to address the implementation and assimilation stages, because the decision to adopt the technology does not exist in such contexts. The paper focused on the development of new network structures is also considered to address the implementation and assimilation stages, because the implementation issues examined in the paper concern the alignment of the new network structure with a technology being adopted and not the decision to adopt.

2. Aligning technologies and networks in implementation projects: A systematic literature review

Stages of implementation	Number of papers	Papers
Adoption	12	Danese et al. (2006) , Hartmann et al. (2009) , Hausman et al. (2005) , Henderson et al. (2012) , Hinkka et al. (2013) , Lee et al. (2005) , Premkumar et al. (1994) , Rivera and Rogers (2006) , Segev et al. (2003) , Shaik and Abdul-Kader (2013) , Sigala (2013) , Tan et al. (2010)
Implementation and assimilation	22	Alin et al. (2013) , Cagliano et al. (2005) , Chae et al. (2005) , Chan and Swatman (2000) , Croom (2001) , Devaraj et al. (2007) , Fosso Wamba et al. (2007) , Gharavi et al. (2004) , Hadaya (2009) , Harty (2005) , Hellström et al. (2011) , Holland and Lockett (1997) , Hung et al. (2011) , Mendoza and Ravichandran (2011) , Power and Singh (2007) , Rajaguru and Matanda (2013) , Ramamurthy et al. (1999) , Setia et al. (2008) , Shaw and Holland (2010) , Shin (2006) , Taylor and Levitt (2007) , Thun (2010)
Both	7	Angeles (2008) , Croom (2001) , Dominguez-Péry et al. (2013) , Kurnia and Johnston (2000) , Loebbecke (2007) , Neubert et al. (2011) , Wakerman et al. (2005)

Table 2.5 – Stages of the implementation process addressed in each reviewed paper

The alignment efforts in general are expected to affect both the adopter and the technology ([Leonard-Barton, 1988a](#)). However, as can be seen in Table 2.6, most of the reviewed studies address only the alignment efforts of the adopter (24). A smaller number covers both adopter and technology (15), and only two focus on the technology.

Alignment efforts	Number of papers	Papers
Adopter	24	Alin et al. (2013) , Chae et al. (2005) , Croom (2001) , Croom (2005) , Devaraj et al. (2007) , Gharavi et al. (2004) , Hausman et al. (2005) , Hellström et al. (2011) , Henderson et al. (2012) , Holland and Lockett (1997) , Hung et al. (2011) , Kurnia and Johnston (2000) , Lee et al. (2005) , Mendoza and Ravichandran (2011) , Power and Singh (2007) , Premkumar et al. (1994) , Rajaguru and Matanda (2013) , Setia et al. (2008) , Shaik and Abdul-Kader (2013) , Shin (2006) , Sigala (2013) , Tan et al. (2010) , Taylor and Levitt (2007) , Thun (2010)
Technology	2	Hartmann et al. (2009) , Segev et al. (2003)
Both	15	Angeles (2008) , Cagliano et al. (2005) , Chan and Swatman (2000) , Danese et al. (2006) , Dominguez-Péry et al. (2013) , Fosso Wamba et al. (2007) , Hadaya (2009) , Harty (2005) , Hinkka et al. (2013) , Loebbecke (2007) , Neubert et al. (2011) , Ramamurthy et al. (1999) , Rivera and Rogers (2006) , Shaw and Holland (2010) , Wakerman et al. (2005)

Table 2.6 – Alignment efforts addressed in the reviewed papers

2.4 FINDINGS

The implementation of a technology in an interorganizational context can be conceptualized as a development process for the technology and the network of organizations, with the purpose of overcoming their misalignments ([Alin et al., 2013](#), [Harty, 2005](#), [Hellström et al., 2011](#)). With this rationale and in order to study the dynamics of that development process, some authors have proposed and tested new alignment frameworks ([Alin et al., 2013](#), [Harty, 2005](#), [Hellström et al., 2011](#)), while others have used existing frameworks, such as the Strategic Alignment Module proposed by [Henderson and Venkatraman \(1993\)](#) ([Dominguez-Péry et al., 2013](#), [Neubert et al., 2011](#)).

The alignment efforts carried out throughout the implementation typically change both the technology and the network. These efforts require adaptations in the structure and

2.4. Findings

functionalities of the technology ([Dominguez-Péry et al., 2013](#)) and in the network's structure and technical setting (namely existing systems and processes) ([Power and Singh, 2007](#), [Shaw and Holland, 2010](#), [Kurnia and Johnston, 2000](#)), as it undergoes a complex series of alignments fostered by interactions between its organizations, which will change their knowledge bases and perceptions of the technology ([Kurnia and Johnston, 2000](#)). When the technical setting, the functionalities, and the structures stabilize, the technology becomes routinized ([Kurnia and Johnston, 2000](#)).

Based on the literature included in this review, we classify these changes, as well as their processes (the alignment processes) as structural alignments (changes in structures and in the sequence or allocation of the business processes), triggered by structural misalignments, or technical alignments (changes in existing systems, functionalities, and in the technical aspects of the business processes), triggered by technical misalignments.

The main source of misalignments is the systemic nature of the adopted technology ([Alin et al., 2013](#)). Systemic technologies have a cross-boundary nature, i.e., they have an impact on different organizations in the network, and their implementations require structural, knowledge and business process integration across those organizations ([Alin et al., 2013](#), [Taylor and Levitt, 2007](#)). Such technologies are composed of smaller subsystems, i.e., modules, which can be designed and managed independently, although they function together as a whole, providing the flexibility to satisfy different needs ([Baldwin and Clark, 1999](#)).

Structural misalignments are misalignments between the modules of a technology and the business processes and structure of the adopting interorganizational network ([Alin et al., 2013](#), [Taylor and Levitt, 2007](#)). Technical misalignments are misalignments between the technology's functionalities and the interorganizational network's objectives, rules, work practices, resources, knowledge basis, existing systems (technologies), and product or service configuration ([Angeles, 2008](#), [Cagliano et al., 2005](#), [Chan and Swatman, 2000](#), [Dominguez-Péry et al., 2013](#), [Hartmann et al., 2009](#)).

This section compiles and presents the findings of the literature review, following the stages of the implementation process: adoption decision, implementation, and outcome (desirably the assimilation of the technology in the network's routines). The subsections "Alignment Process at the Adoption Decision Stage" and "Alignment Process at the Implementation Stage" describe in detail the corresponding stages of the proposed framework, although two alignment processes described in the latter are also relevant for the former. The

considerations about the influence of the alignment process in the outcome of the implementation are described in the subsection “Impact on performance and outcome of the process”. The section ends with the presentation of a conceptual framework that summarizes the findings.

2.4.1 ALIGNMENT PROCESS AT THE ADOPTION DECISION STAGE

Alignment efforts may have to be started even before the implementation stage, at the adoption decision stage ([Angeles, 2008](#), [Chan and Swatman, 2000](#), [Danese et al., 2006](#), [Dominguez-Péry et al., 2013](#), [Henderson et al., 2012](#), [Hinkka et al., 2013](#), [Kurnia and Johnston, 2000](#)):

- The network structure may have to be defined and prepared before the implementation begins so that it is able to adequately support the use of the technology ([Cagliano et al., 2005](#)).
- The lack of compatibility between the technology and the existing systems in the network (e.g., the information systems infrastructure) must be recognized so that the alignment towards an improved implementation outcome can be planned ([Chan and Swatman, 2000](#), [Dominguez-Péry et al., 2013](#), [Neubert et al., 2011](#), [Tan et al., 2010](#)).
- The identification of the business processes that will be improved by the technology can be anticipated and the required changes in those business processes must be planned in the adoption stage ([Dominguez-Péry et al., 2013](#)).
- If the technology relies on social interactions (e.g., a new health prevention program), it is essential to ensure the cultural adequacy between the technology and the network and their context, in aspects such as the communication media, the relationships between users, and the integration with other technologies or other ongoing implementations ([Rivera and Rogers, 2006](#), [Shaw and Holland, 2010](#), [Wakerman et al., 2005](#)).
- It is also important to consider whether the technology is well established in other contexts, in particular in similar networks, to be able to anticipate adaptations in the technology that will be required by the current network of adopters, similar to those required on the other contexts where it is well established ([Dominguez-Péry et al., 2013](#)).

2.4. Findings

These early alignment efforts and plans can start with an evaluation of the potential application of the technology (a structural evaluation of the most interesting technology modules to implement), followed by decisions on where to use it (in the network structure – its organizations – and in its business processes), or with an evaluation of the technical skills and competencies provided by the technology (a technical evaluation of the technology), followed by decisions on what to change in the network's business processes ([Neubert et al., 2011](#)).

Some business process changes predicted at the adoption decision stage, however, may turn out to be infeasible, in case the performance of the technology is not sufficient to ensure a desired level of efficiency ([Loebbecke, 2007](#)). Therefore, and because it is not possible to identify beforehand all the challenges that will be faced during the implementation, any initial efforts in general will not prevent further alignment efforts in both the technology and the network during the implementation stage of the process. Alignment efforts should be continuous and a pilot project can be beneficial, as a starting point, to adapt the technology and the network, providing the possibility of validating the business processes and the alignment between both, prior to extending the implementation to the entire network ([Dominguez-Péry et al., 2013](#)).

2.4.2 ALIGNMENT PROCESS AT THE IMPLEMENTATION STAGE

2.4.2.1 ALIGNMENT PROCESS IN NETWORKS, A NEGOTIATION PROCESS

From the network side, the alignment between a network and a technology results from a negotiation between the organizations in the network, whose different perspectives on the implementation project ([Harty, 2005](#), [Hinkka et al., 2013](#), [Kurnia and Johnston, 2000](#), [Shin, 2006](#)) are thus brought toward a consensus, which is expected to influence positively the outcome of the implementation ([Hausman et al., 2005](#)).

The negotiations begin at the adoption decision stage, and should include all the organizations that participate in the implementation, in order to strengthen the network's implementation planning capability ([Lee et al., 2005](#)). They must assure the alignment of the organizations' resources, motivations, implementation plans and goals ([Cagliano et al., 2005](#), [Dominguez-Péry et al., 2013](#), [Hinkka et al., 2013](#), [Wakerman et al., 2005](#)), and the setting in place of the proper network structure to implement the technology ([Kurnia and Johnston, 2000](#)), aiming at an improved implementation outcome.

2. Aligning technologies and networks in implementation projects: A systematic literature review

Alignment efforts, and the negotiation process, can be led by a single organization (a proactive adopter of the technology), acting as a focal firm in the implementation process ([Chan and Swatman, 2000](#), [Ramamurthy et al., 1999](#)). In such cases, the best long-term strategy for the focal firm is to consider its partners as “extended users” of the technology, sharing resources with them ([Premkumar et al., 1994](#)), instead of coercing them into using the technology. The focal firm must have the expertise required to help its partners implement the technology (develop the appropriate skills and processes), because only the full integration of the technology in the operations of all the network partners will allow the whole network to benefit from the implementation and experience improved performance ([Ramamurthy et al., 1999](#), [Setia et al., 2008](#)).

Alignment efforts can also be led by several or even all of the network organizations, which may suggest adaptations to the technology ([Cagliano et al., 2005](#)) or to the business processes ([Alin et al., 2013](#)), inspired by their learning of how to use the technology ([Alin et al., 2013](#), [Cagliano et al., 2005](#)) and how to interact with each other ([Cagliano et al., 2005](#)).

Industry regulators can also facilitate alignment efforts, by promoting adequate policies for the technology ([Wakerman et al., 2005](#)), for instance by creating new industry rules and standards ([Chan and Swatman, 2000](#), [Gharavi et al., 2004](#)). The latter, in particular, encourage the creation or modification of collaboration networks (structural alignments), as well as the adaptation of specialized knowledge and business processes (technical alignments) to take advantage of the opportunities created by the technology ([Gharavi et al., 2004](#), [Ramamurthy et al., 1999](#)). Standards provide organizations confidence that, having gone through the changes required to implement a technology, they will be aligned with their partners and in the short term no concurrent technologies will be requiring new network structures or business process reengineering. This allows them to take full advantage of the changes and investments that they have carried out ([Ramamurthy et al., 1999](#)). In the case of organizations that are part of multiple networks, as frequently happens in large networks ([Hausman et al., 2005](#)), if no standards are defined, organizations have to weigh the potential operational and relational benefits of adoption versus the complexity costs of maintaining multiple systems ([Hausman et al., 2005](#), [Ramamurthy et al., 1999](#)).

2.4.2.2 THE CASCADING OF ALIGNMENTS

Alignment efforts are incremental and typically involve interactions between alignments of different types ([Neubert et al., 2011](#)), developing in cascades ([Danese et al., 2006](#)):

2.4. Findings

misalignments that fail to be adequately addressed in previous efforts, or that appear as a result of those efforts, may for instance trigger modifications in modules of the technology or the inclusion of complementary modules or technologies ([Danese et al., 2006](#)), leading to a redefinition of the technology, or may trigger modifications in the business processes or the allocation of work, leading in turn to a redefinition of the structure of the network ([Croom, 2001](#), [Alin et al., 2013](#)).

2.4.2.3 ALIGNMENT PROCESSES PROPOSED IN THE REVIEWED PAPERS

Several authors have proposed alignment processes for technology implementations, or technology implementation processes that include alignment considerations. In this subsection we describe these alignment processes and considerations, which are also summarized in Table 2.7.

[Hartmann et al. \(2009\)](#) suggest starting technical alignment processes by carefully observing work routines and gaining tacit knowledge about the network and the reality of the implementation, to define the requirements of the local context, and then, based on those requirements, choosing the appropriate technology to be implemented. This process reduces “the gap between the potential benefits that the [technology] promised for the project and the technical reality of how well the [technology] supported local project routines in detail” ([Hartmann et al., 2009](#)), which in turn leads to a higher acceptance of the technology in the network.

The process proposed by [Hellström et al. \(2011\)](#) focuses on negotiation aspects, aiming at addressing the misalignments between the technology and the network, and between the organizations in the network. The first step in the process is the identification of the risks and gains of the implementation for each organization, and their sources, i.e., the misalignments between each organization and the technology, and between each organization and the other organizations. The distributions of risks and gains for all the organizations are then compared, allowing the identification of “incentive alignment problems” between the organizations, i.e., misalignments between the risks and gains that result from the same sources for different organizations. Finally, for each “incentive alignment problem”, mitigating solutions must be negotiated and agreed between all organizations involved.

[Shin \(2006\)](#) observes that the technology implementation triggers the creation of a new network of organizations. As the network then evolves, the work is redistributed among its

organizations (work allocation alignment), cutting across organizational boundaries and creating new procedures.

[Alin et al. \(2013\)](#) propose an alignment process with three steps: task sequence alignment (classified in this review as a structural alignment), which consists of changing the sequence of existing work tasks to adapt to the requirements of the technology; knowledge base alignment (a technical alignment), which includes the integration of knowledge distributed across the firms in the network, and the actions for keeping the knowledge updated among the users of the technology; and work allocation alignment (a structural alignment), which may occur in different ways – changing the scope or the duration of tasks, using the technology in a novel way when executing a task, creating tasks that did not exist before the implementation, or changing the assignments of tasks to users.

Task sequence alignment helps to align the knowledge basis of the network (technical skills to use the technology, proficiency in managing such technologies, and evaluative expertise to capitalize on the benefits of the technology) with the knowledge basis required by the technology – when using the technology, concurrent tasks provide mutual learning opportunities and sequential tasks provide the flow of required knowledge inputs from earlier to later tasks. Aligning the disparate knowledge basis may also lead to the need for work allocation alignment between the network and the technology – when the network knowledge basis is aligned with the knowledge basis required by the technology, i.e., when knowledge in the network is distributed according to what is assumed by the technology, the organizations of the network are able to align their work allocation to the one assumed by the technology, because their professionals already have the knowledge required to perform the tasks according to the new work allocation.

In line with the structural alignment process suggested by [Alin et al. \(2013\)](#), but focusing on the technical aspects of implementations, [Chan and Swatman \(2000\)](#) suggest that during the implementation process, the most important misalignments to address are, initially, the lack of technical knowledge to use the technology and the lack of understanding of the technology, and in later stages, misalignments related to business processes, namely work practices and cultural adequacy.

Other authors complement this argument, suggesting that the focus and the success of implementation efforts are strongly dependent on the level of maturity of the organizations in the network, in terms of their experience with similar technologies ([Dominguez-Péry et al.](#),

2.4. Findings

[2013](#), [Premkumar et al., 1994](#)). With high levels of maturity, i.e., if a similar technology has already been implemented in the network, is integrated in the business processes, and is being used, the focus of the implementation should be on the alignment of the business processes and the network structure ([Dominguez-Péry et al., 2013](#)). Otherwise, the implementation should be primarily focused on technical aspects ([Dominguez-Péry et al., 2013](#)), namely on the adaptation of the knowledge basis, due to the extensive learning that must take place in technology implementations ([Hausman et al., 2005](#)).

[Taylor and Levitt \(2007\)](#) identify four important mediators that lower the barriers to technology implementations created by misalignments: the stability of the interorganizational relations between the network members, a focus on the network's interests rather than on self interests, the permeability of work boundaries (possibility of changing work allocation), and the existence of a change agent to support and promote required adaptations.

2.4.2.4 STRUCTURAL ALIGNMENT

A structural alignment is a sequential and evolutionary process ([Alin et al., 2013](#)) that may involve creating or adapting the existing interorganizational business processes ([Alin et al., 2013](#), [Angeles, 2008](#), [Danese et al., 2006](#), [Taylor and Levitt, 2007](#)), changing the task sequences and the allocation of work, modifying the structure of the network (linkages or relations between the organizations, network governance structure, or network composition – including new organizations and excluding others), or even creating a new network. It may also involve changes to the technology, namely the adoption of new modules, or even of complementary technologies. These adaptations enable the technology to fully support the intended business processes and achieve a higher level of impact on network performance ([Segev et al., 2003](#), [Shaw and Holland, 2010](#)). Table 2.8 provides a summary of the structural alignment efforts and lists the papers that address each of them.

[Chae et al. \(2005\)](#) argue that technologies are likely to reinforce and stabilize existing network structures and positively affect interorganizational collaboration efforts. The authors suggest that technologies tend not to enhance the creation of new structures, in opposition to other authors, who claim that technologies allow new forms of network structures that would not be possible without them ([Alin et al., 2013](#), [Gharavi et al., 2004](#), [Holland and Lockett, 1997](#), [Ramamurthy et al., 1999](#)).

2. Aligning technologies and networks in implementation projects: A systematic literature review

Authors	Implementation stages	Alignment process
Hartmann et al. (2009)	Adoption	<p>Purpose: reduce the gap between the potential benefits of the technology and the technical reality of how well it supports local routines.</p> <ol style="list-style-type: none"> 1. Observe work routines and gain tacit knowledge about the network and the context of the implementation 2. Define requirements of the local context 3. Based on the requirements, choose the appropriate technology to adopt.
Hellström et al. (2011)	Adoption	<p>Purpose: address misalignments between the technology and the network and between the organizations in the network.</p> <ol style="list-style-type: none"> 1. Identify risks and gains of the implementation for each organization in the network 2. Identify sources of risks and gains, i.e., misalignments between each organization and the technology, and between each organization and the other organizations 3. Compare the distributions of risks and gains between the organizations in the network 4. Identify “incentive alignment problems” between organizations 5. Find (negotiate and agree) solutions to mitigate “incentive alignment problems”.
Shin (2006)	Implementation	<ol style="list-style-type: none"> 1. The implementation triggers the creation of a new network 2. As the network evolves, work is redistributed among its organizations (work allocation alignment), cutting across organizational boundaries and creating new procedures.
Alin et al. (2013)	Implementation	<ol style="list-style-type: none"> 1. Task sequence alignment – change the sequence of tasks to adapt to the requirements of the technology 2. Knowledge base alignment – integrate knowledge distributed across the organizations in the network, and keep knowledge updated between the organizations 3. Work allocation alignment – change the scope or the duration of tasks, use the technology to perform tasks in a novel way, create tasks that did not exist before the implementation, or change the assignment of tasks <p>Task sequence alignment helps to align the knowledge basis of the network with the knowledge basis required by the technology. Aligning the disparate knowledge basis may lead to work allocation alignment between the network and the technology.</p>
Chan and Swatman (2000)	Implementation	<ol style="list-style-type: none"> 1. Align technical knowledge to use the technology and to understand it 2. Align business processes, namely work practices and cultural adequacy.
Dominguez-Péry et al. (2013) , Premkumar et al. (1994) , and Hausman et al. (2005)	Implementation	<p>Complement the process of Chan and Swatman (2000), suggesting that the focus and success of implementation efforts strongly depend on the level of maturity of the organizations in the network, in terms of their experience with the technology or with similar technologies:</p> <ul style="list-style-type: none"> • High maturity – focus on aligning business processes • Low maturity – focus on aligning technical knowledge
Taylor and Levitt (2007)	Adoption and implementation	<p>Mediators to reduce barriers created by misalignments:</p> <ul style="list-style-type: none"> • Stability of the relations between the organizations in the network • Focus on network interests rather than self interests • Permeability of work boundaries to allow work reallocation • Existence of a change agent to support and promote adaptations.

Table 2.7 – Alignment processes and concerns proposed in the reviewed papers

2.4.2.5 TECHNICAL ALIGNMENT

During implementations, the technology must be aligned with the network’s technical setting ([Cagliano et al., 2005](#), [Danese et al., 2006](#), [Hartmann et al., 2009](#), [Hinkka et al., 2013](#), [Loebbecke, 2007](#), [Rivera and Rogers, 2006](#), [Tan et al., 2010](#)), namely with the network requirements for that technology ([Angeles, 2008](#), [Hartmann et al., 2009](#)), and the interorganizational technical setting must be aligned with the appropriate setting to use the

2.4. Findings

technology, in order to improve the outcome of the implementation ([Alin et al., 2013](#), [Angeles, 2008](#), [Chan and Swatman, 2000](#), [Dominguez-Péry et al., 2013](#), [Gharavi et al., 2004](#), [Power and Singh, 2007](#), [Rajaguru and Matanda, 2013](#), [Shaik and Abdul-Kader, 2013](#), [Tan et al., 2010](#)).

Aligning the technology may involve changes to the implemented modules, i.e., adaptations of the technology, for integration with existing systems and to incorporate required functionalities. Aligning the network's technical setting may involve changing its objectives, business processes, work practices, knowledge basis, capabilities, existing systems, rules, resources, and the configuration of the resulting product or service, or even introducing new business processes or new rules. Table 2.8 provides a summary of the technical alignment efforts and lists the papers that address each of them.

Some authors further detail these alignment efforts, observing that the technology should be adapted not only for integration with existing systems, but also to fit the performance requirements of the network ([Loebbecke, 2007](#), [Shaw and Holland, 2010](#)).

On the network side, the business process changes may consist of the elimination of obsolete tasks, the automation or simplification of other tasks, and the creation of new tasks or processes, such as new management capabilities (e.g., intelligent management processes, supply chain integration, or new stock management practices) ([Croom, 2001](#), [Fosso Wamba et al., 2007](#), [Kurnia and Johnston, 2000](#), [Loebbecke, 2007](#), [Shaik and Abdul-Kader, 2013](#), [Shaw and Holland, 2010](#)). Business processes are simplified, accelerated and improved, leading to a positive effect on the network performance, but they may also require changes to the network structure ([Alin et al., 2013](#), [Loebbecke, 2007](#), [Power and Singh, 2007](#)).

Besides business process adaptations, other technical alignments may take place in the network. The organizations in the network may have to change their existing systems to improve data quality, provide acceptable levels of data, or provide accessibility to enable their integration with the technology ([Power and Singh, 2007](#), [Shaik and Abdul-Kader, 2013](#)). They may also have to adapt their knowledge basis to become compatible with any business process adaptations ([Alin et al., 2013](#), [Angeles, 2008](#)).

Regarding management interventions to overcome technical misalignments, providing technical support to adopters (training programs, guidelines concerning the use of the technology, and standards for the technology), and encouraging the integration of the

2. Aligning technologies and networks in implementation projects: A systematic literature review

technology with the existing systems and the reengineering of business processes ([Chan and Swatman, 2000](#)) are essential concerns.

Type of alignment	Alignment effort	Locus of alignment	Authors
Structural	Change the structure of the business processes: <ul style="list-style-type: none"> Task sequence Work allocation 	Network	Alin et al. (2013) , Angeles (2008) , Croom (2001) , Croom (2005) , Dominguez-Péry et al. (2013) , Neubert et al. (2011) , Power and Singh (2007) , Shaik and Abdul-Kader (2013) , Shin (2006) , Tan et al. (2010) , Taylor and Levitt (2007)
	Change the structure of the network: <ul style="list-style-type: none"> Change linkages or relations between the organizations Change network governance structure Change organizations included in the network 		Croom (2001) , Danese et al. (2006) , Dominguez-Péry et al. (2013) , Gharavi et al. (2004) , Harty (2005) , Kurnia and Johnston (2000) , Power and Singh (2007) , Shaik and Abdul-Kader (2013) , Shaw and Holland (2010) , Sigala (2013) , Tan et al. (2010)
	Create new network		Gharavi et al. (2004) , Shin (2006)
	<ul style="list-style-type: none"> Adopt new modules Adopt complementary technologies 		Angeles (2008) , Danese et al. (2006) , Dominguez-Péry et al. (2013) , Harty (2005) , Henderson et al. (2012) , Kurnia and Johnston (2000) , Neubert et al. (2011) , Shaw and Holland (2010)
Technical	Change objectives	Network	Dominguez-Péry et al. (2013) , Rajaguru and Matanda (2013) , Sigala (2013) , Tan et al. (2010)
	Change business processes and work practices		Alin et al. (2013) , Angeles (2008) , Chan and Swatman (2000) , Croom (2005) , Dominguez-Péry et al. (2013) , Fosso Wamba et al. (2007) , Gharavi et al. (2004) , Henderson et al. (2012) , Neubert et al. (2011) , Power and Singh (2007) , Shaik and Abdul-Kader (2013) , Shin (2006) , Sigala (2013)
	Change knowledge basis and network capabilities		Chan and Swatman (2000) , Kurnia and Johnston (2000) , Power and Singh (2007) , Shaik and Abdul-Kader (2013) , Shin (2006) , Sigala (2013)
	Change existing systems		Croom (2005) , Dominguez-Péry et al. (2013) , Fosso Wamba et al. (2007) , Henderson et al. (2012) , Kurnia and Johnston (2000) , Power and Singh (2007) , Rajaguru and Matanda (2013) , Shaik and Abdul-Kader (2013) , Tan et al. (2010)
	Change rules		Angeles (2008) , Gharavi et al. (2004)
	Change resources		Dominguez-Péry et al. (2013) , Power and Singh (2007)
	Change configuration of resulting product or service		Angeles (2008)
	Introduce new business process		Fosso Wamba et al. (2007) , Gharavi et al. (2004) , Kurnia and Johnston (2000)
	Introduce new rules		Gharavi et al. (2004)
	<ul style="list-style-type: none"> Change implemented modules Integrate with existing systems Incorporate required functionalities 	Technology	Angeles (2008) , Chan and Swatman (2000) , Croom (2005) , Dominguez-Péry et al. (2013) , Fosso Wamba et al. (2007) , Hinkka et al. (2013) , Neubert et al. (2011) , Shaw and Holland (2010) , Wakerman et al. (2005)

Table 2.8 – List of papers that study the structural and technical alignment efforts

The organizations in the network must consciously consider the roles that each can play in the implementation, based on their capabilities and those of their partners ([Tan et al., 2010](#)). Strategic, tactical, and operational information sharing among organizations is relevant for the alignment of network roles, and is facilitated by a proper network structure ([Tan et al., 2010](#)). In line with one of the mediators identified by [Taylor and Levitt \(2007\)](#), it has also been suggested that a change agent (or facilitator) may be critical to overcome technical misalignments, by providing support and encouraging the adaptations required to implement the technology, both on the adopter side, regarding the motivation to adopt new business processes and to align objectives and practices ([Cagliano et al., 2005](#), [Sigala, 2013](#)), and on

2.4. Findings

the technology side, regarding the mediation of the choice of modules to implement or not ([Cagliano et al., 2005](#)).

2.4.2.6 RELATIONSHIPS BETWEEN STRUCTURAL AND TECHNICAL ALIGNMENTS

Whether the initial alignment efforts are of a structural or technical nature appears to depend mostly on the maturity of the network and its organizations ([Dominguez-Péry et al., 2013](#), [Hausman et al., 2005](#), [Premkumar et al., 1994](#)), but in any case, subsequent alignments triggered by these initial efforts may come to be of a diverse nature.

As [Alin et al. \(2013\)](#) point out, structural adaptations in the business processes, namely task sequence alignment, may trigger a knowledge basis technical alignment, which in turn may trigger another structural alignment in the business processes, related to work allocation. On the other hand, a technical alignment of the business processes, which may result in the simplification, automation, acceleration or creation of new business processes, may require new network structures, thus triggering structural adaptations ([Alin et al., 2013](#), [Loebbecke, 2007](#), [Power and Singh, 2007](#)). The structural adaptation of the network may enable the alignment of existing systems with the technology, namely by facilitating information sharing between organizations and systems. Information alignment (as a result of a technical adaptation of the existing systems), in turn, may also trigger structural adaptations as it enhances the coordination between the organizations in the network, facilitates the development of the required network structures, and reinforces existing structures, leading to increased performance ([Tan et al., 2010](#)).

2.4.3 IMPACT ON PERFORMANCE AND OUTCOME OF THE PROCESS

There are considerable time lags between the adoption decision and having in place the structures and the technical setting required to benefit from the technology ([Hung et al., 2011](#), [Mendoza and Ravichandran, 2011](#), [Setia et al., 2008](#), [Wakerman et al., 2005](#)). While the alignment between the network and the technology is not achieved, the success of the implementation relies heavily upon interorganizational trust, information sharing, and long-term commitment ([Hung et al., 2011](#)). In their presence, besides having a positive impact on network performance, the technology also contributes to their own reinforcement and stabilization; otherwise, the technology implementation fails. In this sense, their existence should precede the technology implementation efforts ([Chae et al., 2005](#)).

2. Aligning technologies and networks in implementation projects: A systematic literature review

In other words, cultural, strategic and technical alignment between the organizations increases the probability of the network fully realizing the benefits of the technology, and experiencing increased operational performance ([Premkumar et al., 1994](#), [Rajaguru and Matanda, 2013](#), [Shaik and Abdul-Kader, 2013](#), [Thun, 2010](#)).

Additionally, the structural and technical efforts to align the network and the technology, and the management interventions that facilitate them, seek to contribute to a successful implementation of the technology. They increase the likelihood of acceptance of the technology by the users, and its routinization in the operations of the network.

As structural alignments adapt the network structure toward an appropriate configuration for the routine use of the technology, they have a positive effect on network performance ([Alin et al., 2013](#), [Danese et al., 2006](#), [Dominguez-Péry et al., 2013](#), [Rajaguru and Matanda, 2013](#)). When technology and network structures are not aligned, the network cannot fully benefit from the technology ([Thun, 2010](#)). This lack of alignment is usually due to a lack of communication between the organizations, resulting in a lack of strategic alignment between them, non-cooperative behaviour (led by self-interests), lack of discussion about their different perspectives, and underevaluation of the complexity of the implementation or misconceptions about the potential of the technology ([Thun, 2010](#)). Therefore, information alignment between the organizations in the network enhances the coordination between them, facilitates the development of the required network structures, and reinforces existing structures, leading to increased performance ([Tan et al., 2010](#)).

The efforts to align the technical setting of the network with the modules and functionalities of the technology also have a positive effect on network performance and on the acceptance of the technology by the network organizations ([Chan and Swatman, 2000](#), [Hung et al., 2011](#), [Rajaguru and Matanda, 2013](#), [Wakerman et al., 2005](#)). To increase operational performance, the organizations in the network must integrate the technology with the existing systems that support their relationships ([Croom, 2005](#), [Hadaya, 2009](#), [Hinkka et al., 2013](#)), which can be one of the biggest challenges during the implementation ([Croom, 2005](#)). At the same time, they must have in place the systems, knowledge (methods and procedures), and processes to take full advantage of the potential benefits of the innovation ([Devaraj et al., 2007](#), [Shaik and Abdul-Kader, 2013](#)). They must also increase the volume of information they exchange to support the network's business processes ([Hadaya, 2009](#), [Power and Singh, 2007](#), [Sigala, 2013](#), [Thun, 2010](#)).

2.4. Findings

2.4.4 CONCEPTUAL FRAMEWORK

The findings from the literature review cover alignment challenges faced during the adoption decision and implementation stages, as well as the impact of alignment efforts on the outcome of the implementation.

Even though there is still much to be explored, since this is a relatively recent topic (the first paper dates from 1994, Figure 2.1) and research is still limited (only 41 papers with contributions to this topic were found), it is already possible to draw a conceptual framework (Figure 2.5) that consolidates the findings from the literature into a systematic summary of what has been studied so far, and can provide valuable contributions to guide future research (outlined in the Discussion, section 2.5), as well as to the management of implementations of systemic technologies in interorganizational networks.

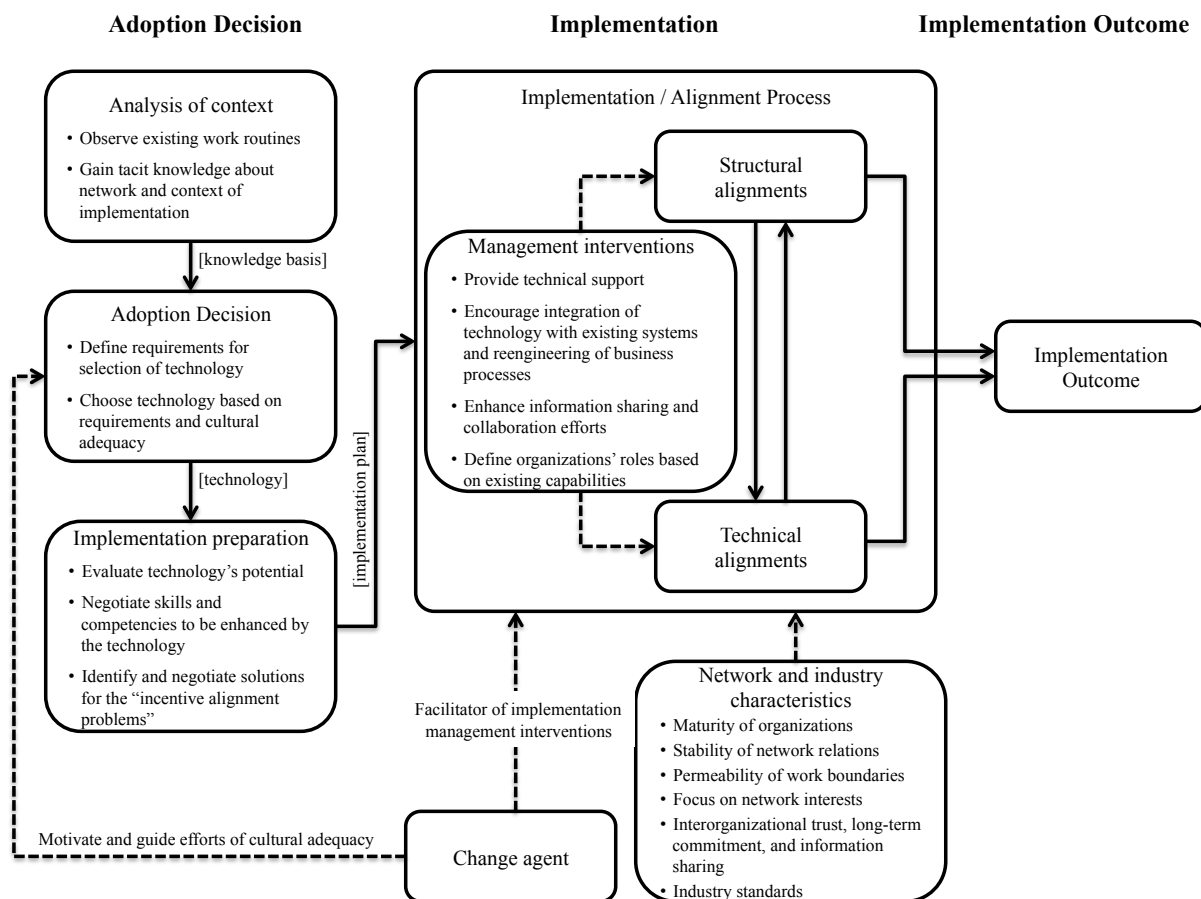


Figure 2.5 – Framework for the process of alignment of systemic technologies and networks of organizations

In the proposed framework, the alignment process is viewed as a complex, sequential and evolutionary process that results from the interactions of multiple types of alignments,

typically in cascade, and involves adaptations that can be structural or technical, both in the technology and in the adopting network. It is usually a long process, with a considerable time lag until the benefits from the technology are realized. The framework is represented visually in Figure 2.5, in which solid edges describe the flow of the implementation process (the dotted edges, and some of the solid edges, account for relations of influence towards enhancing the results of the action related to the affected step).

The findings presented in Section 2.4.1 and the alignment processes proposed by [Hartmann et al. \(2009\)](#) and by [Hellström et al. \(2011\)](#), both presented in Section 2.4.2.3, lead to the three step sequence of the adoption decision stage proposed. It starts with an analysis of the context where the implementation will take place, which includes observing the existing routines in the network and gaining tacit knowledge about the network and the context of implementation. Based on the knowledge built in the first step, the adoption decision step (second step) starts by defining the appropriate requirements for selecting the technology to implement. Then the technology is selected based on those requirements and on an additional analysis of the cultural adequacy of the technology to the context of implementation. The presence of a change agent may be critical to mediate the choice of the technology that fits the requirements defined and the cultural context ([Taylor and Levitt, 2007](#), [Cagliano et al., 2005](#)).

In the final step of the adoption decision stage, after selecting the technology to implement, the organizations in the network start preparing the implementation by evaluating the potential application of the technology, deciding on where to use it and on what technical skills and competencies to change in the network's business processes, and identifying the "incentive alignment problems". Based on the previous decision and on the "incentive alignment problems" they define an implementation plan, including a plan of the structural and technical alignment efforts that will be implemented to mitigate the misalignments identified.

Then, the implementation of the technology begins, following, as closely as possible, the implementation plan defined in the adoption decision stage. The dynamics of the implementation stage are based on the findings presented in Section 2.4.2. A pilot project can be beneficial, as a starting point for this stage, because it provides the possibility of validating the structural and technical alignment between the technology and the network, prior to extending the implementation to the entire network. Whether the implementation starts with

2.4. Findings

structural or technical alignment efforts seems to depend on the level of maturity of the network. In some particular cases, when no network exists prior to the implementation, the implementation starts with the structural alignment efforts needed to create the network, defining the organizations that participate in the network and their relations.

Structural and technical alignment efforts trigger each other, as described in Section 2.4.2.6. For instance, only after the knowledge basis of the network is aligned with the knowledge basis required by the technology will the organizations of the network be able to align their work allocation with the work allocation required by the technology ([Alin et al., 2013](#)).

They are implemented and controlled by implementation managers, and therefore management interventions have an important role in supporting such alignment efforts. However, the literature barely addresses the relation between management interventions and alignment efforts. It is mostly focused on management interventions to overcome technical misalignments, even though some of them are evidently related to structural alignments as well, such as the need for organizations to consciously consider the roles that each can play in the network, which includes their structural positioning in the network, based on their capabilities and those of their partners ([Tan et al., 2010](#)). The scarce findings concerning management interventions, summarized in the “Management interventions” box of the conceptual framework, are presented in the last two paragraphs of Section 2.4.2.5. For instance, the enhancement of information sharing and collaboration efforts helps create new routines and, therefore, overcome technical misalignments.

The participation of a change agent may also be beneficial to overcome misalignments, by providing support and encouraging the adaptations required to implement the technology, such as creating new business processes and new routines, and aligning objectives and practices, on the network side ([Cagliano et al., 2005](#), [Sigala, 2013](#)), or mediating the choice of modules to implement, on the technology side ([Cagliano et al., 2005](#)).

Furthermore, besides the previously mentioned level of maturity, other characteristics of the network and its industry are critical to enhance the possibility for the network to take full advantage of the benefits of the technology, namely stability of network relations, permeability of work boundaries and focus on network interests ([Taylor and Levitt, 2007](#)), interorganizational trust, long-term commitment and information sharing ([Hung et al., 2011](#)), and industry standards ([Gharavi et al., 2004](#)).

Lastly, according to the findings presented in Section 2.4.3, the structural and technical efforts to align technology and network, and the management interventions that facilitate them, seek to contribute to a successful implementation of the technology, increasing the likelihood of acceptance of the technology and its routinization in the operations of the network. . Structural alignment efforts adapt the network structure for the routine use of the technology and enable the technology to fully support the intended business processes. Likewise, the alignment of the network's technical setting with the modules and functionalities of the technology increases the operational performance of the implementation and the level of acceptance of the technology by the organizations of the network.

2.5 DISCUSSION AND FUTURE RESEARCH

The papers included in this review strongly complement and are significantly aligned with each other. This has enabled the construction of a conceptual framework that will be able to support further research on alignment efforts during the implementation of technologies in networks of organizations. Such complementarity and alignment is a positive indicator for the development of research in this topic in the sense that several findings have already been validated across multiple studies. On the other hand, it may also be in part a result of the scarce research that has taken place so far, in particular research with a specific focus on the alignment process, resulting in insufficient diversity of perspectives.

In this section we discuss findings and propose future research directions, following the three stages of the implementation process, also used in the conceptual framework: adoption decision, implementation, and implementation outcome

2.5.1 ADOPTION DECISION

The complementarity between different topics in the implementation literature is clearly expressed in multiple findings. One of them is the negotiation nature of the alignment and implementation processes. Negotiations begin as early as the adoption decision stage, carry on until the end of the implementation process, and even extend beyond. They are important mechanisms for alignment efforts because they enable the consensus among the organizations and enhance the implementation planning capability. They guarantee that the proper network structure, resources, motivations, and objectives are aligned and in place to implement the technology and achieve a successful outcome. By aligning the structure, resources and

2.5. Discussion and Future research

objectives of the organizations in the network, negotiations have an important impact on the ways how some network characteristics influence the implementation process and outcome.

The negotiation nature of the implementation and alignment processes is a stimulating basis for the development of future research, as suggested by several authors. For instance, institutional theory would be a useful lens to examine the different types of pressures that occur between organizations during the adoption decision stage ([Henderson et al., 2012](#), [Premkumar et al., 1994](#)). Other relevant topics include the role of a focal organization in the network in promoting the technology among network partners ([Alin et al., 2013](#), [Taylor and Levitt, 2007](#)), the political and social dynamics of cooperation during the implementation process ([Hausman et al., 2005](#)), and the role of institutional factors, such as standards and norms, in interorganizational alignment and implementation processes ([Alin et al., 2013](#)).

2.5.2 IMPLEMENTATION

The implementation process as an alignment process

The study of alignment efforts during the implementation of technologies in networks of organizations is the primary research purpose of only six of the papers identified in this review (Table 2.4). The remaining papers focus primarily on other implementation topics Table 2.9.

Main topic of research	Papers
Impact of characteristics of the technology, adopter and/or implementation context on the adoption decision or implementation outcome	Chan and Swatman (2000) , Croom (2001) , Croom (2005) , Hartmann et al. (2009) , Hausman et al. (2005) , Henderson et al. (2012) , Hung et al. (2011) , Kurnia and Johnston (2000) , Mendoza and Ravichandran (2011) , Premkumar et al. (1994) , Rajaguru and Matanda (2013) , Ramamurthy et al. (1999) , Shaik and Abdul-Kader (2013) , Sigala (2013)
Impact of the technology on the performance of the adopter	Chae et al. (2005) , Danese et al. (2006) , Devaraj et al. (2007) , Fosso Wamba et al. (2007) , Hadaya (2009) , Power and Singh (2007) , Rivera and Rogers (2006) , Setia et al. (2008) , Shaw and Holland (2010) , Tan et al. (2010)
Power relations between organizations in the network during the implementation process and their management	Harty (2005) , Shaw and Holland (2010) , Shin (2006)
Negotiation process during the adoption decision and during implementation planning	Hartmann et al. (2009) , Hinkka et al. (2013) , Lee et al. (2005)
Management of different difficulties found during implementation process	Loebbecke (2007) , Wakerman et al. (2005)
Technology evaluation processes when deciding what to adopt	Segev et al. (2003)
Learning challenges faced by adopters during the implementation process	Angeles (2008)
Compatibility of specific management methodologies, such as the PDCA process (Plan, Do, Check, Act), with the implementation process	Cagliano et al. (2005)
Patterns of diffusion of technologies in networks of organizations	Gharavi et al. (2004)

Table 2.9 – Main research topics of papers included in the review, excluding alignment efforts

2. Aligning technologies and networks in implementation projects: A systematic literature review

Although implementation is a mutual adaptation process ([Leonard-Barton, 1988a](#)), i.e., a process of alignment between the technology and the network, most of the other topics have stronger traditions in the technology diffusion and implementation literature, which may explain their predominance. However, they all provide important contributions to this review, and some even propose alignment processes ([Chan and Swatman, 2000](#), [Hartmann et al., 2009](#), [Shin, 2006](#)), which confirms the complementarity between alignment and other important topics in implementation, and reinforces the validity and the importance of this review's perspective of the implementation process as an alignment process.

The proposed alignment processes are scarce, built from case study research, which seems natural due to the detail required and to the exploratory nature of such research, and lack confirmation in a sufficiently diverse number of contexts of implementation and types of technology. Notwithstanding, those processes cover the whole implementation process, with two of them focusing on the adoption decision stage ([Hartmann et al., 2009](#), [Hellström et al., 2011](#)), two on the initiation of the implementation stage ([Chan and Swatman, 2000](#), [Shin, 2006](#)), and one on the implementation and assimilation stages ([Alin et al., 2013](#)).

Research interest on alignment efforts in network implementations has increased recently, as can be observed in Figure 2.1. Initially, the topic was of secondary importance, but more recently (since 2007) several studies have started to consider it as the primary focus, while also addressing other important complementary implementation topics.

Despite this increasing interest on the topic, even though alignment efforts in general are expected to affect both the adopter and the technology, most of the studies address only the alignment efforts of the adopter, as can be observed in Table 2.6 and in Table 2.8. Therefore, we suggest that future research complements the current state of knowledge by focusing on alignment efforts of the technology, namely their impacts on the implementation process and on the implementation outcome.

The dynamic nature of the alignment process

The findings related to the dynamics of alignment efforts suggest promising directions for future research. A key finding, which may be intuitive, is the pivotal role of business processes at the intersection of structural and technical alignments. Structural alignments, such as work reallocation and task resequencing, have a clear impact on business processes, through the redefinition of the interactions between organizations and, as a consequence, of

2.5. Discussion and Future research

the network structure. The same happens with technical alignments, which influence the structure of the network namely through changes in the network's knowledge basis. A specific future research direction that can be highlighted in this area is the modification of organizational boundaries in the network throughout the implementation of the technology, caused namely by adaptations in work allocation and task sequencing ([Taylor and Levitt, 2007](#)).

Impact of technical alignment efforts on networks capabilities

Adaptations of the knowledge basis and work practices are technical alignment efforts that have an impact on business processes. This may make some tasks obsolete, which requires their elimination and the adaptation of the respective business process. The technology can also automate or simplify tasks, and even enable the creation of new business processes, changing the network's knowledge basis and enabling new capabilities.

The observation of this impact has led multiple authors to suggest future research directions: the investigation of the effect of the implementation on the capabilities of the network ([Rajaguru and Matanda, 2013](#)); the study of the interaction and simultaneous development of capabilities and usage of the technology ([Tan et al., 2010](#)); the identification of the critical capabilities of best-performing networks, and the assessment of whether deviations from those patterns are likely to result in impaired performance ([Devaraj et al., 2007](#), [Hadaya, 2009](#), [Henderson et al., 2012](#), [Loebbecke, 2007](#), [Tan et al., 2010](#)); and the investigation of industry-specific business process adaptations that may lead to larger benefits from the technology and to the development of new capabilities ([Loebbecke, 2007](#)).

Initial alignments, cascading sequences, and non-linear sequences

As already pointed out in the findings, several authors suggest that the initial alignments are strongly dependent on the level of maturity of the network, in terms of previous experience with similar implementation projects and the use of similar technologies ([Dominguez-Péry et al., 2013](#), [Premkumar et al., 1994](#)). Future research may further verify this assertion by investigating different implementations of the same technologies in networks with different levels of maturity ([Cagliano et al., 2005](#)).

According to [Alin et al. \(2013\)](#) knowledge may be influenced by structural alignment efforts, e.g., task sequence adaptations may require changes in the knowledge basis of the

2. Aligning technologies and networks in implementation projects: A systematic literature review

organizations. Knowledge base alignment (which enables organizations to share knowledge), in turn, may lead to work reallocation, a new structural alignment.

Other similar effects are observed in the literature, suggesting that alignment efforts occur as cascading sequences of alignments and misalignments, possibly with non-linear relations between the types of alignments and misalignments. These are two topics that would be worthy of attention in future research, as they appear to be important mechanisms in the alignment process. The examination of sequences of alignment is also pointed out by several authors as a promising future research direction, namely to investigate the impact of different sequences of alignments on the implementation process ([Neubert et al., 2011](#), [Hadaya, 2009](#)), the influence of the relationships between the organizations in the sequences of alignments ([Dominguez-Péry et al., 2013](#)), and the way how different alignment sequences may produce different future evolutions of an implementation, with corresponding different levels of benefits from the technology ([Croom, 2005](#), [Neubert et al., 2011](#)).

Does technology enhance the creation of new network structures?

The only topic on which opposing perspectives were found in the literature is whether implementations enable or not new forms of network structures. [Chae et al. \(2005\)](#), based on a multiple case study analysis of the impact of Information Technology (IT) implementations on interorganizational collaboration in supply chains, suggest that technologies tend not to enhance the creation of new structures or new interorganizational collaborations, typically leading instead to the reinforcement and stabilization of existing ones. However, the results of the study appear in fact to suggest only that technologies are likely to reinforce and stabilize existing interorganizational structures. The conclusion that technologies do not enhance the creation of new structures is presented as a deduction from that other conclusion, and appears to be in contradiction with other studies that conclude or suggest that new forms of network structures are indeed made possible by the technologies ([Alin et al., 2013](#), [Gharavi et al., 2004](#), [Holland and Lockett, 1997](#), [Ramamurthy et al., 1999](#)). This contradiction may justify further research aiming at understanding whether the creation of new network structures triggered by the technologies is context dependent.

Managerial interventions to support alignment efforts

The topic of managerial interventions to support alignment efforts appears to be less soundly explored. The findings are scarce, concern a limited set of interventions (negotiation efforts,

2.5. Discussion and Future research

the role of change agents in the implementations, and some aspects of the management of technical alignments), and are supported only by a limited number of studies, most of which case research or conceptual research. Appropriate managerial interventions to support and enhance the implementation process, and alignment efforts in particular, is thus a relevant topic for future research, as also suggested by [Sigala \(2013\)](#).

Multiple levels in alignment and implementation processes

Because the implementations addressed in this review take place in networks of organizations, alignments may be required not only at the network level, but also at an organizational level (aligning intraorganizational structures and capabilities). This suggests the interest of future research adopting a multi-level view of interorganizational networks to analyse implementation and alignment processes, as well as the usage of the technology throughout the implementation process ([Shin, 2006](#)). A study identifying the points of contact between this review and the literature on single organizations would be a useful first step in that direction.

2.5.3 IMPLEMENTATION OUTCOME

The impact of alignment efforts on the implementation outcome

The definition of alignment efforts (the efforts that modify both the adopter and the technology during the implementation process) and the identification of their impact on the technology and the adopter (structures, business processes, existing systems, resources, and technology modules, among others) seem to be well supported in the literature by multiple authors using different and complementary research methods.

However, the assessment of the impact of specific types of alignment efforts on the outcome of the implementation appears to be less sound, and in multiple instances supported only by a small number of studies, some of which single case research. The impact of alignment efforts on implementation outcome, therefore, requires further research, namely with an increased diversity of implementation contexts and types of technologies ([Alin et al., 2013](#), [Chae et al., 2005](#), [Danese et al., 2006](#), [Gharavi et al., 2004](#), [Hadaya, 2009](#), [Hellström et al., 2011](#), [Kurnia and Johnston, 2000](#), [Loebbecke, 2007](#), [Rajaguru and Matanda, 2013](#), [Setia et al., 2008](#), [Shaik and Abdul-Kader, 2013](#), [Sigala, 2013](#), [Taylor and Levitt, 2007](#), [Thun, 2010](#)).

Time lags of implementation outcomes

The relationship between the time lag of the implementation process and learning is also a relevant topic for future research. It would be of particular interest to study the tension between the need to quickly change the interorganizational collaboration context, to be able to fully realize the potential of the technology, and the "piecemeal" nature of change in those contexts ([Chae et al., 2005](#)), as well as to explore the effect of knowledge basis change and learning on the time lag ([Mendoza and Ravichandran, 2011](#)). Several authors have also pointed out the importance of longitudinal studies of implementations covering the timespan between the adoption decision and the realization of the full benefits of the technology ([Rajaguru and Matanda, 2013](#), [Mendoza and Ravichandran, 2011](#)).

2.6 CONCLUSION

This paper reviews what is currently known and documented in the management research literature concerning efforts to align technology and adopters during implementations of technologies in networks of organizations. Our systematic literature review aimed, more specifically, at understanding what alignment efforts are, where they have an impact during the implementation process, and what are the management interventions and concerns related to handling the alignment process.

Two review questions were considered. The findings of the review provide a satisfactory answer to the first review question ("How are technology and adopters aligned when an implementation takes place in a network of organizations?"), including relevant and strongly supported conceptions about what alignment efforts are and where they have an impact during implementations in networks of organizations. Nevertheless, the accumulated scientific knowledge about the alignment process still needs further testing and detail, and the identified conceptions require testing in additional implementation contexts and with additional technologies. Conversely, the findings provide some insights to answer the second research question ("How is this alignment managed?"), but the knowledge about alignment management interventions was found to be still scarce and weakly supported, revealing an important opportunity for future research.

This paper provides the management research community a systematic and organized summary of the scientific knowledge about alignment efforts during implementations of technologies in networks of organizations. It also offers a proposal of a conceptual

2.6. Conclusion

framework to guide future research about this topic, namely by summing up and systematizing the findings from the review and interrelating the constructs identified in the literature, and a collection of promising future research directions, some resulting from this review and others already suggested in the literature. Another contribution is the proposed classification of alignment efforts as structural or technical. This might be a modest proposal, because alignment efforts may have an impact on many dimensions (structures, business processes, existing systems, resources, technology modules, and so on), but it is a logical and simple division that may help structure analyses. A final contribution of this paper is the recognition of the relevance of this topic in implementation research, which results from bringing together an existing literature that is significantly scattered among journals and disciplines.

The conceptual framework is the main contribution for practitioners. It may be a useful guide for the implementation of technologies, from the adoption decision to the routinization and acceptance of the technology in the operations of a network. The framework summarizes the findings with a presentation structure that is consistent with a more practical view of the implementation process, relating the key concepts and constructs throughout the three stages of the implementation process (adoption decision, implementation and assimilation or outcome). The framework also considers the important external and network factors that influence the implementation and the process of alignment of the technology and the network of organizations, namely the importance of a change agent as facilitator, the role of standards as incentives for implementation investment, and the importance of interorganizational trust, commitment, information sharing, boundaries permeability, and a focus on the network's interests instead of self-interests, to support successful alignment efforts.

The key limitation of this research is the possibility that some relevant papers have been excluded from the review because they did not fit our search and inclusion criteria. Papers might have been excluded because their journal has been labelled as a technical journal and the paper has not been cited by any of the 41 papers included in the review, or because their journal is not indexed in Scopus or in Web of Science, or because the paper has not been written in English, or because the authors refer to alignment or implementation using other terms (although this was carefully addressed through initial exploratory reviews of the three main research topics: network, implementation, and alignment).

2. Aligning technologies and networks in implementation projects: A systematic literature review

Future research should focus on testing and expanding the conceptual framework in diverse contexts of implementation and with diverse technologies, detailing appropriate managerial interventions, exploring the negotiation nature of the alignment process, further examining alignment processes and sequences of alignment, detailing structural and technical alignment efforts, developing a multi-level view of the implementation process, and investigating the consequences of the time lag between the adoption of the technology and the full realization of its benefits. Two topics of particular interest for future research that emerged from this review are the cascading effects and the non-linear relations between types of misalignments and alignments during the sequence of alignment, which appear to be key mechanisms in the alignment process.

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2. *Aligning technologies and networks in implementation projects: A systematic literature review*

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3 CLASSIFICATION SCHEMES FOR MISALIGNMENTS AND ALIGNMENT EFFORTS DURING TECHNOLOGY IMPLEMENTATIONS IN NETWORKS

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ABSTRACT

This paper proposes two classification schemes for misalignments and efforts of alignment between technological innovations and adopters in implementation projects. The classification schemes are based on the evidence collected from a literature review and a multiple case research of the implementation of a health screening program in networks of health care providers. Generally, four classes are proposed – context, structural, technical, and capacity – the latter not applicable to alignment efforts. The main contribution of these classification schemes is to provide a structured way to systematize operational alignment challenges in implementations of technologies. Such systematization will facilitate building new knowledge in future research based on the classification proposed. This paper also contributes to the understanding of implementations as sequences of alignments by identifying important, yet underexplored, relations between misalignments and alignment efforts throughout the alignment process.

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3.1 INTRODUCTION

For organizations or networks of organizations to be able to successfully integrate new technologies into their operations and benefit from the full potential of their routine use, a good understanding of the implementation process is required ([Edmondson et al., 2001](#)). The implementation process includes activities ranging from the adoption decision to the incorporation of the technology in the routines of the adopter, or its abandonment ([Greenhalgh et al., 2004](#), [Rogers, 2003](#)).

Networks are particularly challenging settings for implementation projects. Contemporary economies are dominated by networks – systems of complementary products or services provided by different organizations ([Alin et al., 2013](#), [Hayes, 2005](#)) – whose operations often involve technological solutions, especially in the scope of the interactions between the network organizations. These networks typically have semi-dependence structures, i.e., their organizations are independent power structures that simultaneously depend on each other to jointly provide a competitive product or service, and thus feature complex behaviours. The fact that network evolution dynamics triggered by the implementation depends not only on the individual organizations, but also on their mutual alignment ([Hung et al., 2011](#), [Taylor, 2005](#)), and the need to orchestrate decisions between multiple organizations ([Dhanarag and Parkhe, 2006](#), [Goes and Park, 1997](#)), make the management of implementations in networks particularly challenging.

Regardless of the locus of adoption, implementations of technologies typically feature misalignments between the technology and the adopter ([Basoglu et al., 2007](#), [Leonard-Barton, 1988a](#), [Wei et al., 2005](#), [Wu et al., 2007](#)), that lead to initial losses of productivity, and to a dynamic sequence of efforts of alignment between the technology and the adopter, throughout the implementation process ([Alin et al., 2013](#), [Choi and Moon, 2013](#), [Leonard-Barton, 1988a](#), [Wei et al., 2005](#)).

Although implementations of technologies have been conceptualized for decades as sequences of alignment efforts, to the best of our knowledge very few frameworks have been proposed to classify misalignments and alignment efforts, and none has really experienced significant diffusing in the implementation management literature.

In an early study of implementations of different technologies in organizations from different industries, [Leonard-Barton \(1988a\)](#) proposed a conceptualization of the implementation

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

process as a sequence of cycles of mutual adaptation between the technology and the adopter, triggered by misalignments, for which she suggested three classes: technical (related to technological specifications and business processes), delivery system (related with the structure of the organization), and value (related with performance criteria used in the organization and its business processes). Analogously, alignment efforts (i.e., the adaptation cycles) might target the technology (by going back to some phase of the technology development process and reinventing it), the organizational performance criteria (by changing performance measures, or business process roles or tasks), or the organizational delivery system (by changing the structure of the organization).

[Power and Singh \(2007\)](#) studied the implementation of Internet technologies in supply chains, and concluded that they require the alignment of structures, processes, and systems among supply chain partners. Similarly, [Shaw and Holland \(2010\)](#) refer the importance of aligning structures and processes when implementing information systems in supply networks and [Rajaguru and Matanda \(2013\)](#) point out the importance of aligning business processes, systems, and structures during the implementation of interorganizational information systems in supply chains.

[Taylor and Levitt \(2007\)](#) examined the implementations of 3D CAD (3D Computer Aided Design) in the construction industry, focusing on a specific class of structural alignment – work allocation alignment. Still in the construction industry, [Alin et al. \(2013\)](#) and [Sackey et al. \(2015\)](#) analysed the implementation of Building Information Modelling (BIM) systems. The former also focused on structural alignments, describing the process of alignment between the technology and the structure of the network of organizations involved in the construction project as a process of task sequence alignment, followed by knowledge base alignment, and then work allocation alignment. The latter suggested four classes of alignment efforts, according to the sociotechnical systems model of [Leavitt \(1965\)](#): structure, task, actor, and technology. When two of these sociotechnical system components become misaligned, mutual alignments and interactions are required to reach a state of alignment, i.e., an equilibrium, between all the components.

Other researchers have not used any classification scheme and simply refer to the objects of specific alignment efforts observed, such as: business processes, business process rules, work practices, or work routines ([Angeles, 2008](#), [Cagliano et al., 2005](#), [Chan and Swatman, 2000](#), [Dominguez-Péry et al., 2013](#), [Hartmann et al., 2009](#), [Henderson et al., 2012](#), [Neubert et al.,](#)

3.1. Introduction

[2011](#), [Shaik and Abdul-Kader, 2013](#), [Tan et al., 2010](#), [Wei et al., 2005](#)); IT infrastructures, or existing systems or equipment ([Chan and Swatman, 2000](#), [Dominguez-Péry et al., 2013](#), [Henderson et al., 2012](#), [Neubert et al., 2011](#), [Tan et al., 2010](#), [Wakerman et al., 2005](#), [Wei et al., 2005](#)); organizational or interorganizational capabilities or competencies ([Angeles, 2008](#), [Chan and Swatman, 2000](#), [Dominguez-Péry et al., 2013](#), [Kurnia and Johnston, 2000](#), [Neubert et al., 2011](#), [Tan et al., 2010](#)); and resources allocation ([Dominguez-Péry et al., 2013](#), [Kurnia and Johnston, 2000](#)).

The diversity of classifications considered in a part of the reviewed studies, and their absence in the remaining, hinders the systematic presentation of results, the comparability of findings from different studies and the development of new knowledge based on previous research. There is, therefore, a very relevant gap regarding the systematization of knowledge about misalignments and alignment efforts, which can be translated into the following research question: “How can misalignments and efforts of alignment between technologies and their adopters during implementations be classified?”. To answer this research question and contribute to fill this gap, we propose two classification schemes, one for misalignments and another for alignment efforts in implementations of technologies, derived from a literature review and a multiple case research of the implementation of a health screening program. After performing an initial exploratory literature review, looking for classification schemes for those two phenomena, and inspired by that literature, we extracted the classes of misalignments and alignment efforts from the case research, which we later confirmed in the data collected from the literature.

In the multiple case research, we focused on implementations in networks of organizations, which, as the most complex implementation scenarios, have the highest potential to feature an exhaustive set of misalignments (at the network, organizational, and individual level). The literature review, however, also included studies of implementations in single organizations. On one hand, this broader effort allowed the inclusion of a wider range of perspectives available in the literature, naturally often more focused and partial. On the other hand, the classes of alignments and misalignments expected to be found are the same, even though the alignment process may be simpler in single organizations, because implementation decisions do not need to be orchestrated between multiple organizations ([Dhanarag and Parkhe, 2006](#), [Goes and Park, 1997](#)).

The remainder of the paper is organized in five sections. Section 3.2 describes the method used for the literature review and the multiple case research. Sections 3.3 and 3.4 present misalignments and alignment efforts that may be found in implementation projects, respectively, and propose classification schemes for each. Section 3.5 discusses the classification schemes and further findings from the case research. Finally, section 3.6 concludes the paper emphasizing the main contributions and managerial implications of this study, and recommending directions for future research.

3.2 METHOD

Classification schemes, i.e., “typologies” or “taxonomies”, are devices for achieving parsimony while describing complex phenomena ([Hambrick, 1983](#), [Doty and Glick, 1994](#)), where sciences have long relied on, based on the premise that “Phenomena of interest do not occur in infinite combinations, at least not with equal likelihood” ([Hambrick, 1983](#)). Furthermore, classifications schemes serve as useful basis for further research and have important pedagogic usefulness ([Hambrick, 1983](#)).

The terms “typology” and “taxonomy” have been used interchangeably in much of the relevant management literature ([Doty and Glick, 1994](#)). However, they are different classification tools since taxonomies are empirically derived, hierarchical classification systems that categorize phenomena into mutually exclusive sets, and typologies are conceptually derived interrelated sets of ideal types, which are defined based on qualities of the observed phenomena and do not provide decision rules for classifying the phenomena ([Rich, 1992](#), [Doty and Glick, 1994](#)). Although taxonomies are conceptualized to be quantitatively based ([Hambrick, 1984](#), [Rich, 1992](#)), in recent literature several taxonomies have been developed based on qualitative research, namely case study research design ([Chiaroni and Chiesa, 2006](#), [Revilla et al., 2005](#), [Rivard and Lapointe, 2012](#)).

The classification schemes that we propose in this paper are based on findings of an inductive multiple case research of the implementation of a diabetic retinopathy screening program in the North of Portugal, confronted with findings from a comprehensive literature review on the management of efforts of alignment between technologies and adopters during implementation projects. We explored data iteratively, going back and forth between the qualitative data and theoretical arguments ([Corbin and Strauss, 2015](#)). The literature review provided a starting point for the analysis of the case studies, and the case studies were used to

3.2. Method

build the classification schemes, inspired and enriched that initial review. Then we went back to the literature to adequately frame the contributions of the case research in the framework.

3.2.1 LITERATURE REVIEW

3.2.1.1 SEARCH STRATEGY AND SELECTION OF PAPERS

The search for the literature review was focused on journal articles and review papers whose titles, abstracts, or keywords included a combination of the following search terms: (implement* OR adopt* OR assimil*) AND (fit* OR align* OR match* OR adapt* OR misfit* OR misalign* OR mismatch*). The asterisk (*) ensures that all words beginning with the part that precedes it are included in the search. For instance, “implement*” will ensure the inclusion of terms such as “implementation”, “implemented”, “implementing”, or “implement”. To define the terms to be included we carried out general analyses of the management literature on implementations of technologies, and alignment.

The papers (journal articles and reviews) were collected from two databases: Scopus (<http://www.scopus.com/>) and Web of Science (<http://apps.webofknowledge.com/>). The search was limited to papers written in English, included in journals or conference proceedings in the research fields of business economics, business management, and management science, and published until the end of 2015.

The papers retrieved from the search were then analysed by a team of three researchers for a match with the research topic, literature concerning misalignments and alignment efforts during implementations of technologies.

3.2.1.2 DATA ANALYSIS

The papers selected for review were analysed using structural and simultaneous coding ([Saldana, 2012](#)). The relevant segments of data were coded using appropriate analysis software, relating them to specific themes. The coding allowed a later comparison of the segments to investigate commonalities, differences, and relationships, for the analysis of specific topics ([Saldana, 2012](#)).

During the coding, additional summaries of each paper were produced and included in a spreadsheet table, capturing the most important data for the synthesis of the findings. The table included the following fields: reference of the paper, number of additional references collected from the paper, method used, methodological quality, objective of the paper,

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

summary of alignment issues considered and theories used, future research directions proposed, technology under study, adopter, industries included in the study, and countries where the study was performed. The synthesis was performed using the data collected in this table, and with the support of the segments of text coded in each paper.

3.2.1.3 DATA SYNTHESIS

The synthesis of findings was performed using interpretation ([Rousseau et al., 2008](#)) together with narrative synthesis ([Briner and Denyer, 2012](#)), because it was driven by an interest in a social phenomenon (the misalignments and alignment efforts occurring during implementation projects) and most of the studies included in the review were qualitative, with primary data not accessible except in published form.

The purpose of the synthesis was to identify higher order concepts, and to provide a larger narrative and generalizable classification of misalignments and alignment efforts found in implementation projects.

3.2.2 MULTIPLE CASE RESEARCH

The implementation of the retinopathy screening program was considered an appropriate setting for this study. It is provided by networks of healthcare organizations and uses a set of technologies that support its operations, it is an important procedure that must be performed by all diabetic patients desirably on a yearly basis ([WHO, 2006](#)), which ensures its continuity, and, since 2009 it is gradually being implemented in the North of Portugal by the Regional Health Authority (RHA).

3.2.2.1 DIABETIC RETINOPATHY SCREENING PROGRAM

The number of people with diabetes mellitus is increasing and will keep increasing in the coming years ([WHO, 2006](#)). In Portugal, its prevalence increased 11% between 2009 and 2014, from 11.7% to 13.1% of the total population ([Diabetes, 2015](#)). Diabetic retinopathy is the major cause of avoidable blindness in the population between 20 and 64 years old. It affects about 98% of type I diabetics and 50% of type II diabetics after 20 years of having diabetes, and evolves quietly, with the symptoms appearing only in the later stages of the disease ([Tavares, 2009](#)). For these reasons, the successful implementation of the retinopathy screening program is very important to reduce the incidence of blindness in the population.

3.2. Method

In the North of Portugal, the diabetic retinopathy screening program is being implemented by the RHA. The screening is provided by networks of hospitals and Primary Care Centre groups (PCC groups), each composed of several Primary Care Units (PCU) distributed in the geographical area covered by the PCC group, and is supervised by the RHA.

The screening program is based on a screening process defined by the RHA ([ARSN, 2009](#)), according to the recommendations of the World Health Organization ([WHO, 2006](#)). The screening process begins with the selection of the diabetic patients who meet the criteria to be screened, which is carried out by the PCU general physicians (GPs). Blind or bedridden patients are not included in the screening. According to a screening plan defined by the RHA together with the local hospital, the PCU secretaries then schedule screening exams for each selected patient, and send out an invitation letter with the time, date and location of the screening.

The screening exam is performed with a portable retinographer, which requires a completely dark room, and also requires a seat with adjustable height, so that the patients' eyes are levelled with the machine lens. A close waiting room allows the patients to be quickly called for the exam. Orthotic technicians travel from the local hospital to the PCU to perform the exams. They take several pictures of the eyes of each patient, according to the screening process guidelines ([ARSN, 2009](#)). The images are then sent to a reading centre for evaluation by ophthalmologist physicians, via the software that supports the screening program, which we will call ScreenSoft.

There is a single reading centre for all North of Portugal, which processes the exams for all the networks in the region. The reading process produces a report for each patient, with one of three possible results: (a) regular, the patient does not have retinopathy; (b) irregular, the patient has retinopathy and needs treatment; or (c) repetition, the exam has to be repeated because the analysis of the images is inconclusive. In the case of the latter, the PCU secretary reschedules the exam and the process is repeated from that point onwards. In cases (a) and (b), the secretary of the PCU informs the patient about the result.

When treatment is required, case (b), a request is automatically sent to the local hospital and to the RHA, including a classification of the case's priority, related to the urgency of treatment, according to the standard classifications defined in the screening process. An ophthalmology secretary in the local hospital schedules treatment sessions and sends an invitation letter to the patient, and an ophthalmology physician performs the treatment. The

patient is excluded from the screening program while being treated, i.e., until discharge. This process is illustrated in Figure 7.1 of Appendix A.

The networks providing the screening are composed by the RHA, a local hospital, the PCC groups served by that hospital, and the reading centre. The technologies being implemented are the screening process, which defines the business processes, their workflow and the methods and materials to be used in the screening program, the portable retinographers to perform the exams, and the ScreenSoft software to support the activities of the different professionals, the information flows between the organizations in the network, and the supervision of the program by the RHA.

3.2.2.2 CASE STUDY DESIGN AND SAMPLING

This part of our work follows an inductive research design, using an embedded multiple case study ([Barratt et al., 2011](#), [Eisenhardt, 1989](#), [Yin, 2009](#)). The research design was embedded because there were multiple levels of analysis ([Eisenhardt, 1989](#)). The primary unit of analysis was the implementation project of the screening program in one network of healthcare providers and the embedded units of analysis were: the network of healthcare providers, the healthcare provider organizations, and the technology being implemented (screening program, retinographers, and ScreenSoft). As case research allows rich, in depth empirical descriptions, and is based on a variety of data sources, it provides a suitable research design for examining and clarifying the type of complex processes that we face in this research ([Yin, 2009](#)) – implementation processes involving a large number of critical actors and factors ([Linton, 2002](#)). Moreover, using diversified case studies and a solid literature support, we were able to gather insightful scientific data to analyse and constructs to extract, as suggested by [Eisenhardt \(1989\)](#).

Eight cases were selected, using a theoretical sampling strategy ([Barratt et al., 2011](#), [Corbin and Strauss, 2015](#), [Eisenhardt, 1989](#)) with representativeness of four dimensions:

- Network structures, including networks in which the reading centre is in the local hospital, contrary to what was planned and has been previously described previously, and others in which it is in the hospital defined for that purpose
- Structures of the screening program, including some networks in which the screening exam is performed at a central location rather than in every PCU as initially planned

3.2. Method

- Stages of the implementation process, including some networks that had completed only one round of screening and networks that had already concluded two or three rounds, and thus already had more experience with the screening program
- And implementation contexts, including networks located in mostly urban areas, where the population is geographically concentrated, and others located in mostly rural areas, where the population is spread.

This sampling strategy ensures external validity ([Barratt et al., 2011](#), [Voss et al., 2002](#), [Yin, 2009](#)) and helps guard against observer bias ([Barratt et al., 2011](#), [Voss et al., 2002](#)). The sample was large enough to reach theoretical saturation ([Corbin and Strauss, 2015](#), [Eisenhardt, 1989](#)).

Table 3.1 describes the eight cases, highlighting for each network the number of interviews performed, the dimensions, the number of rounds completed, the date when the screening program started, and the number and the distribution of patients served by each network.

Network	Number of interviews	Number of PCC groups	Number of organizations	Number of rounds	First round	Population	Distribution of population
RHA	2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1	4	1	4	3	2009	183 618	urban / concentrated
2	8	2	4	1	2011	351 716	urban / concentrated
3	7	2	5	2	2011	360 410	urban / concentrated
4	6	2	4	2	2011	358 865	urban / concentrated
5	7	3	5	2	2010	305 219	rural / spread
6	3	1	4	2	2012	282 211	rural / spread
7	4	2	5	1	2012	367 662	rural / spread
8	5	1	4	1	2013	166 093	rural / spread

Table 3.1 – Description of cases (the RHA line is not a case, it just records the two managers with the responsibility for all the implementations, who are based in that institution)

3.2.2.3 DATA COLLECTION

We conducted 46 retrospective semi-structured interviews in order to obtain different perspectives and cross check responses about factual issues, ensuring construct validity ([Yin, 2009](#)). Besides the two implementation managers, who are the same for the eight networks, in each network we interviewed at least one general physician and one secretary for each PCC group, and at least one orthotic technician and one ophthalmologist physician from the local hospital. The only exception was network 6, for which no ophthalmologist physicians were interviewed. However, the network was not excluded from the case research because, after analysing its data, we realized that they were only concerned with topics in which the ophthalmologist physician was not involved (interactions between the PCC group and the reading centre, and orthotic technician capacity). The interviews were based on a protocol

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

organized after familiarization with the screening program and the network operations of each case, which ensured reliability ([Yin, 2009](#)).

This research followed the RHA's guidelines for research governance and ethics. Before each interview the interviewee was asked to sign an informed consent approved by the RHA's ethics committee. The interviews were recorded and transcribed using appropriate analysis software. Only one interviewee declined to have the interview recorded. In that case the interview was conducted with the participation of two researchers, the collected data were crosschecked and a report was written immediately after the interview, increasing the accuracy of the data collection process. The interviews were transcribed as soon as possible, allowing a first analysis of the collected data and the improvement of the subsequent interviews ([Barratt et al., 2011](#), [Corbin and Strauss, 2015](#), [Eisenhardt and Graebner, 2007](#)). The interviews lasted from 11 minutes to 1 hour and 16 minutes, with an average of 30 minutes and a total of approximately 22 hours and 30 minutes, resulting in 395 pages of text transcribed verbatim ([Yin, 2009](#)).

We also collected archival documentation, including official documents of the screening program (its procedure manual and presentations), annual activity reports of the RHA containing and commenting its results, independent reports mentioning its evolution (such as the annual reports of the national observatory for diabetes), and media news about its implementation and results. We also collected statistical data on the outcomes of the different stages of the program (screening exam, reading and reporting, and treatment) for the eight networks included in the research, and exchanged emails with the interviewees whenever any question remained unanswered after the interviews or emerged during data analysis.

The triangulation of these multiple sources of evidence provided credibility and strengthened our results ([Barratt et al., 2011](#), [Corbin and Strauss, 2015](#), [Eisenhardt, 1989](#), [Yin, 2009](#)).

3.2.2.4 DATA ANALYSIS

The analysis was divided in two stages: (1) within case analysis, selecting and organizing the relevant data and searching for within case patterns, and (2) cross-case analysis, searching for cross-case patterns ([Barratt et al., 2011](#), [Eisenhardt, 1989](#)).

We started the within case analysis with a fine-grained reading of the data ([Corbin and Strauss, 2015](#)). We performed a descriptive and simultaneous coding, using appropriate qualitative analysis software (NVivo), in which sets of text were coded with topics that

3.3. *Misalignments*

summarize their contents and parts of text that suggested multiple meanings were coded with two or more topics simultaneously ([Miles et al., 2014](#), [Saldana, 2012](#)). A second coding cycle was also completed using pattern coding to lay the groundwork for cross-case analysis by developing common themes, based on the topics of the questions used in the semi-structured interviews ([Miles et al., 2014](#)). For each case study, as a result of within case pattern matching, a report bringing together and organizing the collected data was written and reviewed by peer researchers and by key informants, once more ensuring construct validity ([Yin, 2009](#)).

After being validated, the data from each report were compiled in role-ordered matrices and in a partially ordered meta-matrix ([Miles et al., 2014](#)), assembling descriptive data from each of the cases in standard formats to facilitate the cross-case analysis. Those matrices served as a database for the cross case analysis and ensured reliability of data collection by helping to minimize observers biases ([Easterby-Smith et al., 2012](#), [Yin, 2009](#)). Role-ordered matrices associated the descriptive codes to each interview, allowing for pattern identification among the roles of the interviewees of the different networks. The partially ordered meta-matrix associated summaries of the data from each network to each descriptive code, organizing the data to simplify the cross-case pattern matching. These matrices then allowed us to classify misalignments and alignment efforts identified in the several case studies and to build causal chains that represented the several sequences of alignments observed in each network ([Miles et al., 2014](#)).

Data were then analysed using pattern matching within and among the matrices and among the causal chains, and comparing the findings with the findings from the systematic literature review, which ensured internal validity ([Yin, 2009](#)).

3.3 MISALIGNMENTS

Misalignments between a technology and its adopters result from a lack of compatibility between them ([Alin et al., 2013](#), [Choi and Moon, 2013](#), [Leonard-Barton, 1988a](#)), and emerge dynamically and often unpredictably during an implementation process, especially in its beginning ([Wei et al., 2005](#)). They influence performance at different levels – network, organizations, units, and personnel – and meet with different evaluation criteria and perspectives about the implementation process at each of those levels ([Leonard-Barton, 1988a](#)) and throughout the implementation process ([Griffith, 1999](#)).

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

The new technology may initially be outperformed by current technologies, as misalignments inevitably lead to temporary losses of productivity, often higher than anticipated ([Leonard-Barton, 1988a](#), [Wei et al., 2005](#), [Wu et al., 2007](#)). However, the existence of misalignments may also be beneficial for the network in case they introduce a higher systematic order into the network's operations ([Darbanhosseiniamirkhiz and Wan Ismail, 2012](#), [Leonard-Barton, 1988a](#)).

The implementation is defined based on the ability to resolve misalignments between the technology and its adopter ([Majchrzak et al., 2000](#)). Misalignments are thus the driver of change, or in other words, they are the need to align the technology and the adopters ([Leonard-Barton, 1988a](#)). The consequent sequence of alignments ([Hanson et al., 2011](#), [Neubert et al., 2011](#)), or process of mutual adaptation ([Leonard-Barton, 1988a](#)), between the technology and the adopter that takes place during the implementation is thus difficult to plan and often has an unforeseeable outcome ([Wei et al., 2005](#)).

The main source of misalignments faced throughout an implementation project is the systemic nature of the technology being adopted ([Alin et al., 2013](#)). Systemic technologies are cross-boundary technologies (affecting different organizations of the network) whose implementation requires structural and technical integration by the network of organizations assembled to use them ([Alin et al., 2013](#), [Taylor and Levitt, 2004](#)).

We conceptualize misalignments observed in the case research following a broad classification as context, structural, technical, and capacity. Inspired by the general classifications of some papers included in our review, they are organized in a classification scheme with two levels (Table 3.2). In the first level misalignments are divided in context misalignments, which are identified before starting the implementation, and delivery system misalignments, which are only identified during the implementation process, i.e., while implementing the technology as it was planned, and are divided in the three classes of the second level: structural, technical and capacity misalignments.

In this section we define the four classes (context, structural, technical, and capacity misalignments) and identify the key characteristics of networks and technologies that can lead to each, based on the data collected from the case research and confirmed with the data collected in the literature reviewed. An immediate benefit of this classification scheme of misalignments is facilitating the identification of subsequent alignment efforts to resolve them. The misalignments identified in the case research are summarized in Table 3.3.

3.3. Misalignments

Class 1	Definition	Class 2	Definition	Literature
<i>Context misalignments</i>	Misalignments identified before the implementation starts			Dezdar and Ainin (2011) , Hallikainen et al. (2009) , Hartmann et al. (2009)
<i>Delivery system misalignments</i>	Misalignments identified during the implementation process	<i>Structural misalignments</i>	Misalignments between the structure of the adopter and the structure of the technology	Alin et al. (2013) , Danese et al. (2006) , Dominguez-Péry et al. (2013) , Frohlich and Dixon (1999) , Jones and Price (2004) , Kishore and McLean (2007) , Kurnia and Johnston (2000) , Lee and Lee (2000) , Leonard-Barton (1988a) , Power and Singh (2007) , Sackey et al. (2015) , Shaik and Abdul-Kader (2013) , Shaw and Holland (2010) , Taylor and Levitt (2007)
		<i>Technical misalignments</i>	Misalignments between the technical system of the adopter and the functionalities of the technology	Angeles (2008) , Cagliano et al. (2005) , Cao et al. (2013) , Chan and Swatman (2000) , Chou et al. (2013) , Danese et al. (2006) , Dezdar and Ainin (2011) , Dominguez-Péry et al. (2013) , Frohlich and Dixon (1999) , Garza-Reyes et al. (2015) , Hadaya (2009) , Hallikainen et al. (2009) , Hartmann et al. (2009) , Hartmann (2011) , Hellström et al. (2011) , Hong and Kim (2002) , Jones and Price (2004) , Kurnia and Johnston (2000) , Lee and Lee (2000) , Lee et al. (2005) , Leonard-Barton (1988a) , Liang et al. (2007) , Lim and Koh (2009) , Molina (1997) , Momoh et al. (2010) , Power and Singh (2007) , Premkumar et al. (1994) , Rajaguru and Matanda (2013) , Sackey et al. (2015) , Segev et al. (2003) , Shaik and Abdul-Kader (2013) , Shaw and Holland (2010) , Siemberger et al. (2009) , Thun (2010)
		<i>Capacity misalignments</i>	Misalignments between resources allocated to the implementation and those required to use the technology	Cao et al. (2013) , Dominguez-Péry et al. (2013) , Meyers et al. (2012) , Power and Singh (2007) , Sackey et al. (2015)

Table 3.2 – Classification scheme proposed for misalignments

Class	Misalignments identified	Networks
Structural	MS1 – Misalignment between planned and feasible work allocations	1, 2, 3, and 8
	MS2 – Traveling difficulties created by work allocation	1, 3, 4, 5, 7, and 8
Technical	MT1 – Lack of administrative data sharing between organizations of the network	1, 2, 3, 4, 7, and 8
	MT2 – Lack of access to information due to absence of appropriate conditions	1, 3, and 8
	MT3 – Unpredicted need of information sharing	1, 2, 3, 6, and 7
	MT4 – Need to include further work activities	5
Capacity	MC1 – Lack of workforce capacity	All
	MC2 – Lack of transportation capacity	5
Context	Misalignment between implementation plan and operational context of the network	4 and 5

Table 3.3– Summary of the misalignments identified in the case research, and the networks in which they were identified

3.3.1 CONTEXT MISALIGNMENTS

A context misalignment is a lack of compatibility between the technology and the local operational context of the network ([Hartmann et al., 2009](#)). These misalignments may be identified before the implementation begins by comparing the local operational context with

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

the expected context to use the technology ([Hartmann et al., 2009](#)). Context misalignments will require structural, technical or capacity alignment efforts in order to align the local operational context of the network (structure, technical setting, or capacity) with the technology's structure and/or functionalities. However, as shown by the following evidence from the case research, what distinguishes context misalignments from the other classes is the fact that the former are identified proactively, i.e., before the implementation begins and the structure, technical setting and installed capacity are tested, while the latter are identified reactively (after implementing the technology). Context misalignments, therefore, trigger the negotiation of preventive alignment efforts, in order to start the implementation with a better alignment between the technology and the operational context of the network.

According to this definition of context misalignments, one could ask whether misalignment MS1 of networks 3 and 8 (presented in Section 3.3.2.1.1) should not be considered context misalignments. In fact, even though in those cases the structural misalignment was identified prior to the implementation its identification was inspired by the implementations in other networks, namely in network 1 (the pilot project).

3.3.1.1 INSTANCES OF CONTEXT MISALIGNMENTS

Two context misalignments were observed in the cases studies, one in network 4 and the other in network 5. Both refer to misalignments between the implementation plan and the local context in which the network operates.

The screening exam was planned to be carried out in the PCUs of each network and read in a regional reading centre, located in the hospital of network 2. However, the hospital of network 4 already had its own local screening program implemented, which was not expected and was not the case in the other networks. The hospital managers were interested in keeping the local screening program running, in particular because of their commitments with the institutions that were financing their screening equipment (fixed machines that could not be transported to the PCUs, unlike the machines bought by the RHA). This context triggered negotiations between the hospital managers of network 4 and the implementation managers, leading to an agreement containing structural and technical alignment efforts (AS1, AT2, and AT5) before starting the implementation.

In network 5 a new ophthalmology centre was inaugurated just before the beginning of the implementation of the new screening program. That centre could devote a lot of capacity to

3.3. *Misalignments*

the execution of the screening program, as it still had few routine patients, and its professionals were also interested in using the new local screening machines (fixed as in network 4). This context also triggered negotiations between the hospital managers of network 5 and the implementation managers, leading to the agreement of structural and technical alignment efforts (AS1 and AT2) before starting the implementation.

3.3.2 STRUCTURAL MISALIGNMENTS

A structural misalignment, as the name suggests, is a lack of compatibility between the structure of the technology and the structure of the network, i.e., between the modules of the technology and the business processes and organizational structure of the network adopting it ([Alin et al., 2013](#), [Taylor and Levitt, 2007](#)). The systemic complexity of the technology and the network structure are the two elements that may lead to structural misalignments ([Alin et al., 2013](#), [Barlow et al., 2006](#)).

Systemic complexity refers to the structure of the users that are integrated in a same system to use the technology ([Alin et al., 2013](#), [Barlow et al., 2006](#), [Fichman, 1992](#)). It defines the different organizations whose operations will have to be coordinated in the implementation (how work and the use of the technology will be allocated between them), and whether or not a new network structure or a new structural organization between the technology's modules will be required ([Alin et al., 2013](#), [Barlow et al., 2006](#), [Fichman, 1992](#), [Leonard-Barton, 1988a](#)). Measuring the systemic complexity of a technology to be implemented in a network thus requires knowing the different units of adoption (organizations) that will use the technology, and how they will be connected ([Barlow et al., 2006](#)).

Network structure can be described by a set of factors derived from network theory, such as size, centralization, homogeneity, connection density, connection strength, blindness, and stability ([Borgatti et al., 2009](#), [Linton, 2002](#), [Tichy et al., 1979](#)). Nevertheless, in the context of structural misalignments, the important factors to characterize the network structure are those that are relevant for its comparison with the technology systemic complexity: the number of organizations (size), the structure of the connections between organizations, and the strength of each connection – the degree of dependency or social ties between organizations ([Hausman et al., 2005](#), [Palinkas et al., 2014](#), [Taylor, 2005](#)).

3.3.2.1 INSTANCES OF STRUCTURAL MISALIGNMENTS

Two structural misalignments were observed in the case research, which we call misalignments MS1 and MS2 (Table 3.3). The former is a misalignment between the planned and the feasible work allocations in each network, and the latter consists of traveling difficulties created by the final allocation of work in the network.

3.3.2.1.1 *MS1 – Misalignment between planned and feasible work allocations*

Misalignment MS1 was related to the allocation of work among the network organizations. This misalignment was observed in networks 1, 2, 3, and 8, which felt difficulties in performing the screening program in every PCU, because some of the PCUs did not have an appropriate room for the retinography, or because it was difficult to move the retinographer between some of the PCUs. This is a structural misalignment between the structure planned for the screening program and the structures that were feasible for the networks.

In network 1 the screening was rotating between the different PCUs during the first round (an experimentation round, since the implementation of the screening in this network was a pilot project for the North of Portugal). That first round revealed that it would not be possible to maintain the rotation of the screening, because some PCUs lacked the space to accommodate the screening and/or had bad accessibility for some patients, and because there were bad transportation conditions for the machine (retinographer) and the orthotic technician. In network 2 the impossibility of maintaining the screening rotation was mainly due to difficulties in the transportation of the machine from PCU to PCU. In networks 3 and 8 the screening never got to operate as initially planned, because the managers of the PCC groups predicted that it would be difficult to rotate the screening between all the PCUs, mainly due to the space and machine transportation difficulties mentioned above.

3.3.2.1.2 *MS2 – Traveling difficulties created by work allocation*

Misalignment MS2 concerned difficulties arising from the structure of the network created by the allocation, or reallocation, of work among its organizations. In networks 1, 3, 4, 5, and 8 patients had difficulties traveling to the location where the screening program was being performed, because the journeys were long and expensive. In network 7 the professionals also felt these difficulties, because the screening was performed in every PCU and the technicians had a fixed and limited time per day allocated to it, which reduced their availability for the most distant PCUs.

3.3. *Misalignments*

The nature of this misalignment is structural because the transportation difficulties are caused by the operational structure of the screening program, which affects the allocation of work among the organizations of the network. In the case of networks 1, 3, 4, 5, and 8, work allocation makes it difficult for some patients to attend the screening, reducing the rate of participation (one measure of the implementation outcome). In the case of network 7, it reduces the availability of the professionals to perform the screening in the PCUs most distant from the local hospital, creating a capacity misalignment (capacity misalignment MC1).

In network 1, due to misalignment MS1 the screening was centralized in a single PCU, i.e. there was a structural alignment effort of reallocation of work among organizations of the network (structural alignment effort AS1). As a result of that reallocation of work some patients started experiencing difficulties visiting that PCU, due to the absence of transportation services or the complexity of the required travel plans. Moreover, in this network some patients also experienced transportation difficulties with their visits to the local hospital for treatment. This misalignment (MS2), therefore, is observed twice in this network and results from the reallocation of the screening site (centralization in one PCU) and from the allocation of the treatment (to the local hospital). In this network professionals consider that the reduced participation rate observed between the first and the second round (Table 3.4) was due to this misalignment.

In network 3 some patients had difficulties finding transportation to the screening site that were causing some of them to miss the exam. As mentioned above, in this network the screening was performed in a central PCU since the beginning of the first round. In one of the PCC groups, some patients had difficulties in finding transportation to the first screening site (the headquarters of the PCC group), located in one end of the PCC group. In a structural alignment effort, the screening was therefore moved to a PCU located in the centre of the PCC group (structural alignment effort AS1). The nearest public transport stops, however, were distant from the PCU and the path to the PCU included a steep hill, which created additional difficulties for the elderly. Transportation difficulties, therefore, remained for some patients even after changing the screening site.

In networks 4 and 5 the screening was performed in a central location, the local hospital. This reallocation of the screening resulted from context misalignments previously described, in Section 3.3.1.1. In these networks, some patients had difficulties traveling to the screening

site, because of the need to change means of transportation multiple times, or because of age-related mobility difficulties.

In network 7 the screening was performed in every PCU, as initially planned. The technicians travelled from the hospital to the PCU where the screening was being performed and then back to the local hospital to finish their workday duties in the ophthalmology service. The traveling time was included in the time available for the screening, which meant less time available to perform the screening for most distant PCUs. The structure of the network, therefore, led to capacity misalignments (capacity misalignment MC1) for some of the PCUs.

In network 8 the fact that population is very spread out also creates difficulties in traveling to the PCUs, and hinders patient participation.

3.3.3 TECHNICAL MISALIGNMENTS

A technical misalignment is a lack of compatibility between the technology's functionalities and the network's business processes (rules and work practices), knowledge basis, and existing systems ([Angeles, 2008](#), [Cagliano et al., 2005](#), [Chan and Swatman, 2000](#), [Dominguez-Péry et al., 2013](#), [Hartmann et al., 2009](#)).

One of the sources of technical misalignments is the technology's learning complexity ([Bhattacharya, 2012](#)). When it is not aligned with the business processes (what is performed), the work practices (how it is performed), the capabilities and knowledge basis, or the existing systems of the network, a technical misalignment emerges.

Learning complexity is the degree to which a technology is perceived as difficult to understand and use ([Rogers, 2003](#)), in terms of the technical setting it requires ([Berta et al., 2005](#), [Linton, 2002](#)). The technical setting of the network refers to the business processes (rules and work practices), knowledge basis and consequent capabilities, and existing systems. In general, higher degrees of diversity and newness of the required technical setting correspond to higher complexities ([Edmondson et al., 2001](#), [Linton, 2002](#)). The technology is perceived as difficult to use, or complex to learn, if the network's technical setting is not aligned with the required technical setting. As a perception, learning complexity is a subjective characteristic and different networks may evaluate it differently for the same technology.

3.3. Misalignments

Network- PCC group	Rounds (finished until 2013)	First round (beginning)	2010		2011		2012		2013	
			Patients called	Affluence	Patients called	Affluence	Patients called	Affluence	Patients called	Affluence
1-a	2	2009			7 986	5 835 – 73.1%			10 201	5 347 – 52.4%
2-a	1	2011					11 651	5 591 – 48.0%		
2-b	2	2011			8 686	4 814 – 55.4%			5 790	2 460 – 42.5%
3-a	2	2011			8 924	4 240 – 47.5%			9 973	3 570 – 35.8%
3-b	2	2011					8 796	4 421 – 50.3%	9 602	4 842 – 50.4%
4-a	1	2012							9 140	5 757 – 63.0%
4-b	2	2011					7 754	4 451 – 57.4%	12 884	8 065 – 62.6%
5-a	3	2010	3 673	2 908 – 79.2%			5 016	3 155 – 62.9%	2 851	1 908 – 66.9%
5-b	1	2011					6 108	3 191 – 52.2%		
5-c	1	2011			6 165	3 281 – 53.2%				
6-a	1	2012							16 206	11 279 – 69.6%
7-a	1	2012							9 998	5 994 – 60.0%
7-b	1	2012							7 908	4 716 – 59.6%
8-a	1	2013							9 423	5 603 – 59.5%

Table 3.4 – Participation in the screening per network and PCC group (including the number of rounds completed, the date of the beginning of the first round, the total number of patients called per round, and the number and percentage of participants per round)

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

Another source of technical misalignments is the network maturity in what concerns the prior experience of the network and its organizations with technologies similar to the one being implemented, and with similar implementation projects ([Berta et al., 2005](#), [Hausman et al., 2005](#)). Maturity provides organizations, and consequently the network, with a better technical setting for the implementation ([Hausman et al., 2005](#)). Furthermore, according to some organizational theorists, mature organizations bring prestige to the networks that they integrate, especially to the parts of the network that connect directly to them, which might be advantageous for implementations ([Oliver, 1990](#)), especially if they support the new technology. However, more mature organizations also tend to be older, which, as believed in another organizational theory perspective, may be a disadvantage in implementation projects, since they feature more deeply established routines that increase their resistance to change ([Salimath and Jones, 2011](#), [Sørensen and Stuart, 2000](#)). These conflicting views indicate that maturity is a characteristic that should be regarded with caution ([Linton, 2002](#)).

3.3.3.1 INSTANCES OF TECHNICAL MISALIGNMENTS

Four technical misalignments, which we call MT1, MT2, MT3, and MT4 (Table 3.3), were observed in the case research. Misalignments MT1, MT2, and MT3 resulted from a lack of information sharing between the organizations in network, with a negatively influence on the performance of some business processes. MT1 was related to the sharing of information that did not exist in the network and was outside the scope of the screening program, although it had an impact on the screening activities. In MT2 some of the professionals in some of the networks lacked access to information, due to the absence of appropriate conditions to access the information (for instance appropriate systems), or to deliberate choices of the implementation managers to decrease the quality of the information and increase the number of patients included in the screening. MT3 was related to information sharing whose inclusion in the screening program plan could be predicted to be important, but was not and thus hurt the performance of some activities. In MT4 adaptations of the network structure in turn required the adaptation of the screening program's operations, with the inclusion of additional work activities in the existing business processes, which will be further explored in Sections 3.3.4.1.1 (capacity misalignment MC2), 3.4.2.1.3 (technical alignment effort AT3), and 3.4.3.1.2 (capacity alignment effort AC2).

3.3. Misalignments

3.3.3.1.1 MT1 – Lack of administrative data sharing between organizations of the network

Misalignment MT1 was related to a lack of sharing of administrative data between PCUs and local hospitals, which led to a shortage in the information required to select the patients to be included in the screening process. This is thus a misalignment between the information sharing that existed in the network and that required to effectively operate the screening program.

In networks 1, 2, 3, 4, 7, and 8 some patients that were being referred to treatment through the screening program were already being monitored or treated in the local hospitals by the ophthalmology services, i.e., their retinopathy was already being treated. GPs did not exclude those patients from the screening program because they were not aware of which patients were already being followed in the local hospital, or because they had instructions from the PCC group managers to encourage the participation in the screening regardless of whether patients were already being treated or not. As a consequence, when those patients were sent to treatment, their appointments were duplicated in the hospital. Some technicians started feeling demotivated in their screening-related activities due to this work duplication. The situation also created among some professionals in the hospital the idea that no selection was being carried out for the inclusion of patients in the screening (creating incorrect perceptions of the screening operations).

In networks 3 and 8 it was also observed that some patients missed the exam because they were already being monitored or treated at the hospital or in private care, or because they lived in a location different from the location of the PCU where they were registered. This misalignment was consequently also having a negative impact in the implementation outcome, undermining one of its metrics, the participation rate. Participation appeared to be worse than it really was, because patients that were already being treated and thus did not come to the screening should not have been called in the first place.

3.3.3.1.2 MT2 – Lack of access to information due to absence of appropriate conditions

Misalignment MT2 resulted from the lack of access to information, or inaccuracy in the information shared between the organizations in the network, about the results of the screening. In networks 1, 3, and 8 the ophthalmology physicians had difficulties in planning the treatments because they could not access the retinographies performed in the PCUs and their results, or because the information included in the report and the quality of the images

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

were not sufficient to support decisions on how to proceed. In network 8 GPs also did not have access to the screening results, information that would be important for an appropriate selection of patients in the following rounds of the screening. This is a technical misalignment of the screening program with an impact on the performance of the network operations. It is a misalignment between the information required for a good performance in some activities and that available for the professionals who carry out those activities.

In network 1, the ophthalmology physicians in the local hospital complained that in some cases the classification of patients sent to treatment was not consistent with their real condition. In those cases, the images of the screening performed at the PCU did not have sufficient quality to allow for a proper examination, which may also explain the lack of accuracy in the classification of the urgency of treatment at the reading centre, and the retinography had to be repeated before any decision concerning the treatment could be made. In this network, the technical misalignment in the information shared was due to insufficient quality of one of the work tasks performed at the PCU (the retinography). This was a deliberate misalignment assumed by the implementation managers (at the RHA), because in order to be able to perform the screening at PCUs and to include the largest possible number of patients, the retinographers had to be portable, and portable retinographers have a lower image quality.

In network 3, the same ophthalmologist physicians could not access the screening reports sent by the reading centre or older retinographies, which were erased from the RHA database after being stored for a short period of time. The retinographies may be important for follow-up appointments, in which the ophthalmology physician may need to check old results in order to better evaluate the patient's condition and treatment plan. This technical misalignment in information shared was due to a lack of adequate systems in the local hospital to support the access to the screening reports, and to a lack of data storage capacity in the RHA, allowing the retinographies to be kept for a longer period (desirably forever).

In network 8 the ophthalmologist physicians again did not have access to the retinographies performed at the PCUs, because the hospital did not have a PACS – Picture Archiving and Communications System. In this network GPs did not have access to the reports with the results of the screening, which would be important information for a more efficient selection of the patients in the following rounds. The network featured two variations of this technical misalignment: the first variation consisted of a lack of adequate supporting systems in the

3.3. Misalignments

local hospital, i.e., the PACS that would allow access to the retinographies; the second consisted of a possible lack of training of the GPs, since GPs in other networks had access to the results and used the same systems.

3.3.3.1.3 MT3 – *Unpredicted need of information sharing*

Misalignment MT3 was related to a lack of information sharing between the technicians and the reading centre, concerning specific information of importance for the performance of the subsequent activities of reading and treatment. In networks 1, 2, 3, 6, and 7 the technicians were not able to share with the reading centre their assessment of the urgency of having each patient's retinography read, according to their perceptions of whether the patient needed treatment or not, as well as the stage of the disease. This information would allow a prioritization of the readings, and a faster forwarding of the most urgent patients to treatment. This is a technical misalignment of the screening program, for which the need for this information sharing flow had not been predicted, with negative implications on the performance of some of the activities that are part of the network's operations, namely readings and treatments.

3.3.3.1.4 MT4 – *Need to include further work activities*

Misalignment MT4 resulted from the need to create new work activities because of the inclusion of new member organizations in the network. In network 5, structural misalignment MS2 triggered the inclusion of new members organizations in the network (structural alignment effort AS2), with the responsibility of transporting patients from the PCUs to the local hospital (where the retinography was performed). These new members, however, had limitations in the number of patients that could be transported, or the availability of the transportation vehicle (capacity misalignment MC2). Due to this lack of transportation capacity, the screening schedule had to be aligned with the availability of the vehicle: in each round, the slots available to schedule the screening were constrained by the daily availability of the vehicle and the number of patients that the vehicle could transport. A new work activity, therefore, had to be defined to have local PCC group managers, transportation provider, local hospital, and RHA agree on a schedule at the beginning of each new round.

Similarly, because of the PCU patients who used public transportation, the local hospital had to constrain the screening slots available to the period during which transportation was available.

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

These are two misalignments between the work practices planned for the screening program (at the beginning of each round the RHA would define the scheduling slots) and the work practices needed to perform the screening in this particular network (at the beginning of each round the scheduling slots have to be defined by the RHA, together with the PCC groups, the local hospital, and the transportation providers).

3.3.4 CAPACITY MISALIGNMENTS

A capacity misalignment is a lack of compatibility between the capacity of the network, i.e., the resources (professionals and tangible assets) available for the implementation project, and those required to use the technology ([Meyers et al., 2012](#), [Power and Singh, 2007](#)). Capacity misalignments are closely related to technical misalignments, although the former refer to the amount of resources available, whereas the latter refer to what can be achieved with those resources, or what those resources are capable of doing. For the implementation project it is fundamental to ensure that adequate resources are available to use and support the technology ([Meyers et al., 2012](#)). In networks of organizations, specifically, it is important to integrate available resources and share asset specific investments among organizations of the network ([Power and Singh, 2007](#)).

3.3.4.1 INSTANCES OF CAPACITY MISALIGNMENTS

Two capacity misalignments were observed in the cases studies, which we call MC1 and MC2 (Table 3.3). Misalignment MC1 concerns insufficient workforce capacity to perform the screening in a timely manner, and misalignment MC2 is related to lack of transportation capacity, in network 5, to move the patients from the PCUs to the local hospital, where the screening is performed.

3.3.4.1.1 MC1 – Lack of workforce capacity

In misalignment MC1, the networks lacked a sufficient number of professionals to perform the screening effectively. Every studied network experienced the effects of insufficient workforce capacity to perform some of the business processes included in the screening: lack of secretaries to perform administrative tasks, lack of technicians to perform the screening on time, lack of reading capacity and difficulties starting treatments on time due to lack of ophthalmology physicians. This misalignment concerns the resources available in the network, and hampers the performance of the screening, and therefore the performance of the

3.3. Misalignments

implementation, namely in accomplishing the target times for the different business processes (scheduling patients, screening patients, reading retinographies, and starting treatments).

Networks 1, 2, 5, 6, and 8 experienced lack of secretaries to perform administrative tasks. As the secretaries of the PCUs and the local hospitals were already fully occupied with the other tasks that they had to perform, and no new secretaries were hired to perform the tasks related to this screening program, they became overloaded at the beginning of the implementation of the screening. In some networks, the secretaries were able to perform the screening tasks in extra hours, however in other networks the screening started to become delayed.

Networks 3, 4, 5, 6, and 7 experienced lack of technicians to perform the screening on time. Network 3 had three local hospital technicians performing the screening, rotating monthly, to avoid having one of the technicians with exclusive dedication. However, the number of technicians was not sufficient for both the hospital and the screening work, and often the hospital work became delayed. There have been efforts, namely from the RHA, to hire another technician to solve this difficulty, but this has not yet been possible. In network 6, similarly to network 3, the number of local hospital technicians was not sufficient to perform both the hospital and the screening work, and often the hospital work became delayed. Network 4 had two PCC groups, but the local hospital did not have sufficient technicians to have all the patients screened within the timings targeted by the screening program (one year). The hospital took almost that time just to screen the patients of a single PCC group.

In network 5 the screening program began at the same time that the ophthalmology centre opened. At the beginning the centre had plenty of availability to perform the screening and screened a high number of patients per day. But over time the centre started to have more patients to follow and its availability for the screening was reduced. Furthermore, the number of professionals started to decrease, especially because most of the professionals had been displaced from their hometowns and the working conditions that were offered in that centre were not attractive. As a consequence of the increase in workload, one of the services that were possible during the first round (having one technician perform the screening in a PCU to the patients of the most distant PCC group), became infeasible in the following rounds.

In network 7 the screening was performed by three technicians who divided the work among them. They performed the screening only twice a week, one hour and a half in the morning and one hour and a half in the afternoon, each day. The remainder of their working day time was dedicated to their duties at the local hospital. The time spent on the screening was

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

therefore very limited and hurt the performance of each round, in terms of their durations. There have also been signs of difficulties managing the technicians, especially when one technician had to miss work, a case in which the hospital still had to send one technician to perform the screening and consequently had insufficient resources for the local service.

All networks experienced delays in the screening due to lack of reading capacity. The local hospitals of networks 1, 3, 6, 7, and 8 had no exam reading capacity. Their readings were therefore carried out in the reading centre, located in network 2. During the initial rounds of the screening the readings took too long, leading to a delay of close to one year in the availability of the reports with the results, and the ability to proceed with the required care. Some patients complained about the lack of feedback and some refused to continue to participate in the screening before they knew the results of the first exam, which led to a lower participation (one of the outcome measures of the implementation). In addition, the reports were sent in peaks, and not continually as expected, which was creating difficulties in managing the workload of the professionals at the local hospitals with responsibilities for the treatments, and was leading to delays in starting the treatments.

In network 4, the retina appointment were the hospital's outpatient appointments with more operational difficulties, because of the large number of patients with conditions requiring that kind of appointments. According to a study of the Portuguese Healthcare System Central Administration the hospital's ophthalmology service had four elements less than those required for a proper performance of the service. That lack of workforce capacity created a delay in the readings of the exams (three months instead of a desired time of less than one month). In network 5, the increasing workload at the ophthalmology centre started to delay the communication of the results of the screening, which in turn started to delay the beginning of subsequent rounds, and started to raise difficulties to the management of the PCC groups, whose KPIs were in part concerned with the times of the screening program.

Finally, networks 1, 3, 4, 7, and 8 experienced difficulties in starting the treatments on time, also due to lack of workforce capacity, but for different reasons in each network. In network 1 the treatments stopped for over a year, between the end of 2011 and the beginning of 2013, as can be observed in Table 3.5, where between 2011 and 2012 the cumulative number of patients that started treatment remained at 165. When they restarted, due to the many efforts of a new service management, the list of patients for treatment was very long and, naturally, had a vast delay. In network 3 the local hospital did not have enough ophthalmologist

3.4. Efforts to align network and technology

physicians to comply with the required time for treatment. During the first round of the screening no treatment had begun, and treatments were, therefore, starting with a delay when compared to the timings defined by the screening program, although the situation had been improving. In network 4 the lack of workforce capacity was also creating a delay in treatment initiation, with a time of about 100 days, instead of the desired 30, to start a treatment. Networks 7 and 8 also had insufficient ophthalmology physicians to start treatments on time. In network 7 ophthalmology physicians even accepted to receive the patients forwarded by the screening program in extra time appointments, to reduce the negative impact of the lack of professionals.

3.3.4.1.2 MC2 – Lack of transportation capacity

Misalignment MC2 resulted from the lack of transportation capacity by new network members that had the responsibility for a new transportation service. In network 5, misalignment S2 triggered the inclusion of new members in the network (structural alignment effort AS2), responsible for the transportation of patients from the PCUs to the local hospital (where the retinography is performed). Those members had limitations concerning the number of patients that they could transport, or the time period during which they had the vehicle available per day, since the same vehicle was used to ensure other transport services, such as transportation of children for school. This lack of transportation capacity required the extension of the screening period in several PCUs and delayed the global time of the screening program in that network.

Network	Accumulated number of initiated treatments		
	2011	2012	2015
1	165	165	687
2	95	112	770
3	52	54	576
4		270	1 110
5	49	105	145
6		0	710
7		21	218
8			340

Table 3.5 –Cumulative number of patients that initiated treatment per network

3.4 EFFORTS TO ALIGN NETWORK AND TECHNOLOGY

Alignment is a state that can be reached through an alignment process ([Hanson et al., 2011](#)), i.e., through efforts of change in the technology and/or the adopter with the objective of increasing their compatibility.

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

The challenge for the adopter is to create new interdependencies and capabilities, or modify existing ones, in a way that enables the efficient use of the technology ([Bolívar-Ramos et al., 2012](#)). Implementation managers thus assess the impacts of misalignments throughout the implementation process, with the adopter's performance criteria, and accordingly modify or create elements of its structure, technical setting and capacity, to bring them close to what an efficient use of the technology requires. Similarly, implementation managers may also promote changes in the learning and systemic complexities of the technology to better adjust it to the adopter's operations, namely by informing and negotiating changes with the technology provider.

These alignment dynamics reduce the lack of compatibility between the technology and the adopter, as described in Section 3.3, following the principle of mutual adaptation cycles ([Leonard-Barton, 1988a](#)) or sequences of alignment ([Alin et al., 2013](#), [Neubert et al., 2011](#)). The sequences may be initiated by the implementation managers ([Basoglu et al., 2007](#), [Wei et al., 2005](#)) or may occur naturally, triggered by the natural evolution of the implementation project ([Choi and Moon, 2013](#), [Darbanhosseiniamirkhiz and Wan Ismail, 2012](#)). The alignment efforts may involve adaptations in the structure, technical setting, and capacity of the adopter, and/or in the structure and functionalities of the technology ([Power and Singh, 2007](#), [Shaw and Holland, 2010](#), [Dominguez-Péry et al., 2013](#), [Meyers et al., 2012](#)).

Accordingly, we propose to classify alignment efforts as structural, technical, and capacity. Unlike misalignments, there are no context alignment efforts, because one cannot change the context but can change the delivery system to adapt to the context, i.e., the operational context of the network and the structure and/or functionalities of the technology may be changed through structural, technical or capacity alignment efforts to adapt to the local context.

Alignment efforts are organized in a classification scheme with two levels (Table 3.6). In the first level they are divided into structural, technical, and capacity alignment efforts. In the second level each of the classes of the first level is decomposed in the different alignment efforts identified in the literature and case research.

3.4. Efforts to align network and technology

Class 1	Definition	Class 2	Locus of alignment	Literature
Structural	Alignment efforts of the structure of the adopter and the structure of the technology	Change the structure of the business processes: <ul style="list-style-type: none"> Task sequence Work allocation 	Network	Alin et al. (2013) , Angeles (2008) , Croom (2001) , Croom (2005) , Dominguez-Péry et al. (2013) , Frohlich and Dixon (1999) , Hartmann (2011) , Hong and Kim (2002) , Luo and Strong (2004) , Neubert et al. (2011) , Power and Singh (2007) , Shaik and Abdul-Kader (2013) , Shin (2006) , Tan et al. (2010) , Taylor and Levitt (2007)
		Change the structure of the network: <ul style="list-style-type: none"> Change linkages or relations between the organizations Change network governance structure Change organizations included in the network 		Croom (2001) , Danese et al. (2006) , Dominguez-Péry et al. (2013) , Frohlich and Dixon (1999) , Gharavi et al. (2004) , Harty (2005) , Hong and Kim (2002) , Jones and Price (2004) , Kishore and McLean (2007) , Kurnia and Johnston (2000) , Lee and Lee (2000) , Power and Singh (2007) , Štemberger et al. (2009) , Shaik and Abdul-Kader (2013) , Shaw and Holland (2010) , Sigala (2013) , Tan et al. (2010)
		Create new network		Gharavi et al. (2004) , Shin (2006)
		<ul style="list-style-type: none"> Adopt new modules Adopt complementary technologies 	Technology	Angeles (2008) , Danese et al. (2006) , Dominguez-Péry et al. (2013) , Hartmann (2011) , Harty (2005) , Henderson et al. (2012) , Kurnia and Johnston (2000) , Molina (1997) , Neubert et al. (2011) , Shaw and Holland (2010)
Technical	Alignment efforts of the technical system of the adopter and the functionalities of the technology	Change objectives	Network	Dominguez-Péry et al. (2013) , Hartmann (2011) , Molina (1997) , Rajaguru and Matanda (2013) , Sigala (2013) , Tan et al. (2010)
		Change business processes and work practices		Alin et al. (2013) , Angeles (2008) , Chan and Swatman (2000) , Chou et al. (2013) , Croom (2005) , Dominguez-Péry et al. (2013) , Fosso Wamba et al. (2007) , Frohlich and Dixon (1999) , Garza-Reyes et al. (2015) , Gharavi et al. (2004) , Hallikainen et al. (2009) , Henderson et al. (2012) , Hong and Kim (2002) , Jones and Price (2004) , Kishore and McLean (2007) , Lee and Lee (2000) , Luo and Strong (2004) , Molina (1997) , Neubert et al. (2011) , Panayiotou et al. (2015) , Power and Singh (2007) , Shaik and Abdul-Kader (2013) , Shin (2006) , Sigala (2013) , Štemberger et al. (2009)
		Change knowledge basis and network capabilities		Chan and Swatman (2000) , Garza-Reyes et al. (2015) , Hartmann (2011) , Jones and Price (2004) , Kurnia and Johnston (2000) , Lee and Lee (2000) , Luo and Strong (2004) , Molina (1997) , Power and Singh (2007) , Shaik and Abdul-Kader (2013) , Shin (2006) , Sigala (2013)
		Change existing systems		Croom (2005) , Dominguez-Péry et al. (2013) , Fosso Wamba et al. (2007) , Frohlich and Dixon (1999) , Henderson et al. (2012) , Kishore and McLean (2007) , Kurnia and Johnston (2000) , Molina (1997) , Power and Singh (2007) , Rajaguru and Matanda (2013) , Shaik and Abdul-Kader (2013) , Štemberger et al. (2009) , Tan et al. (2010)
		Change rules		Angeles (2008) , Gharavi et al. (2004) , Lee and Lee (2000)
		Change configuration of resulting product or service		Angeles (2008)
		Introduce new business process		Fosso Wamba et al. (2007) , Gharavi et al. (2004) , Kurnia and Johnston (2000)
		Introduce new rules		Gharavi et al. (2004)
		<ul style="list-style-type: none"> Change implemented modules Integrate with existing systems Incorporate required functionalities 	Technology	Angeles (2008) , Chan and Swatman (2000) , Croom (2005) , Dominguez-Péry et al. (2013) , Fosso Wamba et al. (2007) , Frohlich and Dixon (1999) , Hallikainen et al. (2009) , Hinkka et al. (2013) , Hong and Kim (2002) , Kishore and McLean (2007) , Luo and Strong (2004) , Molina (1997) , Neubert et al. (2011) , Shaw and Holland (2010) , Wakerman et al. (2005)
Capacity	Alignment efforts between the resources allocated to the implementation and those required to use the technology		Network	Dominguez-Péry et al. (2013) , Power and Singh (2007) , Kurnia and Johnston (2000)

Table 3.6 – Classification scheme proposed for alignment efforts

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

In this section we describe the three first level classes, and identify the key characteristics of the adopters and the technologies that they influence, based on the case research and confirmed with the literature reviewed. We focus specifically on evidence about adopters that are networks of organizations. The alignment efforts identified in the case research are summarized in Table 3.7.

Class	Alignment efforts identified	Networks
Structural	AS1 – Work reallocation among organizations of the network	1, 2, 3, 4, 5, and 8
	AS2 – Inclusion of a new organization in the network	5
	AS3 – Creation of a new business process	5
	AS4 – Adoption of a complementary technology	2
Technical	AT1 – Change of business process rules	1, 4, 5, 6, 7, and 8
	AT2 – Changes in work practices	1, 2, 4, 5, and 8
	AT3 – Creation of new work practices	1, 2, 3, 4, 5, and 7
	AT4 – Change of existing systems	5
	AT5 – Integration of screening with existing systems	4
	AT6 – Creation of new work practice to provide new means of information sharing	4
	AT7 – Changes in functionalities of the screening program	4 and 5
	AT8 – Creation of new functionalities in the screening program	1, 2, 3, 6, and 7
Capacity	AC1 – “Hire” more professionals	1, 2, 4, 6, and 8
	AC2 – Change number of screening slots per round	5

Table 3.7 – Summary of the alignment efforts identified in the case research, and the networks in which they were identified

3.4.1 STRUCTURAL ALIGNMENT EFFORTS

Structural alignment efforts, in contrast to structural misalignments, are efforts of change in the structure of the network and/or the structure of the technology in order to align them, i.e., to overcome structural misalignments between them, and enable the technology to fully support the intended operations of the network, and achieve a higher level of impact on its performance ([Segev et al., 2003](#), [Shaw and Holland, 2010](#)).

In the network of organizations adopting the technology, structural alignment efforts may involve:

- The creation of new, or the adaptation of existing, business processes, by changing the sequences of tasks and the allocation of work among the network organizations ([Alin et al., 2013](#), [Dominguez-Péry et al., 2013](#), [Neubert et al., 2011](#), [Power and Singh, 2007](#), [Angeles, 2008](#), [Croom, 2001](#), [Croom, 2005](#), [Danese et al., 2006](#), [Shaik and Abdul-Kader, 2013](#), [Shin, 2006](#), [Tan et al., 2010](#), [Taylor and Levitt, 2007](#))
- The modification of the structure of the network, by changing the linkages or the relations between its organizations, its governance structure, or its composition, i.e. the set of organizations that are part of the network ([Danese et al., 2006](#), [Dominguez-Péry et al., 2013](#), [Power and Singh, 2007](#), [Croom, 2001](#), [Gharavi et al., 2004](#), [Harty,](#)

3.4. Efforts to align network and technology

[2005](#), [Kurnia and Johnston, 2000](#), [Shaik and Abdul-Kader, 2013](#), [Shaw and Holland, 2010](#), [Sigala, 2013](#), [Tan et al., 2010](#))

- Or even the creation of a new network ([Gharavi et al., 2004](#), [Shin, 2006](#))

In the technology, the structural alignment efforts involve the adoption of new modules or complementary technologies ([Danese et al., 2006](#), [Dominguez-Péry et al., 2013](#), [Neubert et al., 2011](#), [Angeles, 2008](#), [Harty, 2005](#), [Henderson et al., 2012](#), [Kurnia and Johnston, 2000](#), [Shaw and Holland, 2010](#)).

The correspondence between structural alignment efforts found in the literature and those found through case research is represented in Table 3.8.

Structural alignment efforts		Technical alignment efforts		Capacity alignment efforts	
Literature	Case Studies	Literature	Case Studies	Literature	Case Studies
Creation of new / Adaptation of business processes	AS1 – Work reallocation among organizations	Change / Create business process rules	AT1 – Change business process rules	Change capacity / “Hire” more resources	AC1 – Hire more professionals
		Change / create work practices	AT2 – Change of work practices		
	AS3 – New business process	Change / Create knowledge basis and capabilities	AT3 – Creation of new work practices		
		(none)	(none)		
Change the structure of the network	AS2 – New organization included in the network	Change / Create information sharing means and flows	AT6 – Creation of new means of information sharing		AC2 – Change number of screening slots per round
		Change existing systems	AT4 – Changes in existing systems		
Creation of new network	(none)	Change modules of technology to integrate with existing systems	AT5 – Integration of ScreenSoft with existing system		
		Change modules of technology to incorporate required functionalities	AT7 – Changes in functionalities		
Adoption of new modules or complementary technologies	AS4 – Adoption of complementary technology	Creation of new functionalities	AT8 – Creation of new functionalities		

Table 3.8 – Relation between alignment efforts found in the literature and through case research

3.4.1.1 INSTANCES OF STRUCTURAL ALIGNMENT EFFORTS

The structural alignment efforts observed in the case research were grouped in four subclasses, that we call AS1, AS2, AS3, and AS4 (Table 3.7). The first refers to work reallocation among organizations of the network, the second to the inclusion of new organizations in the network, and the third to the inclusion of a new business process. The third is related to the second, consisting of the inclusion of a new business process brought by new organizations. These observed structural alignment efforts aimed at overcoming

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

structural or context misalignments. The fourth refers to a planned implementation of a complementary technology, which had not yet taken place, but for which implementation managers were still looking for a solution by the end of our fieldwork.

3.4.1.1.1 AS1 – Work reallocation among organizations of the network

Alignment effort AS1 consisted of a reallocation of the screening, usually to a centralized location for the whole network. It was observed in networks 1, 2, 3, 4, 5, and 8. In networks 1, 2, 3, and 8 it was implemented to overcome a structural misalignment, and in networks 4 and 5 to overcome a context misalignment.

In network 1, the difficulty in maintaining the screening rotating between different PCUs (structural misalignment MS1) led to a reallocation of work among organizations of the network and to the centralisation of the screening in one single PCU, which had the appropriate conditions to accommodate the screening. However, this centralization caused some patients to experience difficulties in traveling to the PCU, due to the absence of transportation services or difficult traveling plans (structural misalignment MS2).

Network 2 has two PCC groups. In one of them the screening was centralized in one primary care unit, and in the other the primary care units were divided in three areas, with approximately the same number of patients, and in each area the screening was performed in a central unit. The units where the screening was performed tended to remain the same from round to round so that the patients knew easily where to go when called. The decision to centralize the screening in one or in three units was mainly due to difficulties in transporting the machine to other units (structural misalignment MS2).

In network 3 the managers of the PCC groups understood that it would be difficult to operate a screening rotating between all the PCUs (structural misalignment MS1), which led to a centralization of the screening in one single PCU for each PCC group, since the first round of the program. In PCC group 3-a, the screening was initially centralized in one PCU located at one end of the PCC group, but this created transportation difficulties for the patients that lived in the other end (structural misalignment MS2). When the local managers realized those new difficulties, the screening was moved to a PCU located at the centre of the PCC group, which also had a room with the appropriate conditions to receive the screening. However, as explained in Section 3.3.2.1.2 (structural misalignment MS2), the nearest public transport stops were distant from the PCU and the path had a steep hill, which created additional

3.4. Efforts to align network and technology

difficulties for elderly patients (structural misalignment MS2), not yet resolved. In PCC group 3-b the screening was centralized in the PCU with the emergency care, because it was a location already well known by most of the patients. In the second round of the screening, local managers decided to experiment changing the location of the screening to a more central PCU for the whole PCC group. However, the participation seemed to decrease because fewer patients knew where it was located, and the screening was reallocated back to the first place.

In network 4 the screening was centralized in the local hospital, which performed the screenings, readings and treatments. This alignment effort was motivated by the fact that there was a screening program already being organized and completely operated by the local hospital (context misalignment), which made the implementation managers agree to keep the screening centralized.

In network 5 the screening was centralized at the local hospital, because it had a new ophthalmology centre offering attractive conditions to perform the screening (context misalignment). The professionals of this ophthalmology centre performed the screenings, the readings, and the treatments. In the first round the local hospital was also receiving patients from some PCUs belonging to another network's PCC group (PCC group 7-a), because the locations of those units were close, their network did not have yet a screening running, and the ophthalmology centre had sufficient capacity to screen and treat their patients. However, in the PCC group farthest from the ophthalmology centre (PCC group 5-b), where patients had more transportation difficulties (structural misalignment MS2), the second round of the screening was performed in a local PCU, with a portable machine that the RHA made available. This alignment effort increased patient participation. However, as the ophthalmology centre's workload progressively increased and the number of professionals decreased (capacity misalignment MC1), the local hospital had to stop providing this service and the screening was centralized in the ophthalmology centre for all the PCC groups again.

In network 8 the screening was performed in two PCUs, each serving half the network. This alignment was planned since the beginning of the screening because, similarly to network 3, the managers understood that it would be difficult to maintain the screening rotating between the different PCUs (structural misalignment MS1). At the same time, the local managers decided to centralize to two PCUs instead of just one, to improve accessibility, because in this network patients were very spread (structural misalignment MS2).

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

3.4.1.1.2 AS2 – Inclusion of a new organization in the network

Alignment effort AS2 was observed in network 5. It aimed at overcoming the difficulties of some patients in traveling to the ophthalmology centre for the screening (structural misalignment MS2). In some PCC groups, local managers approached the municipalities to seek transportation from the PCUs to the ophthalmology centre for their patients. Some of the municipalities agreed and were therefore included in the network, together with a new service (structural alignment effort AS3).

3.4.1.1.3 AS3 – Creation of a new business process

Alignment effort AS3 was also observed in network 5 and is related to alignment effort AS2. It refers to the new service (the transportation service) brought by the new members of the network (the municipalities). It consists of the inclusion of a new module (a business process) in the technology (the screening program) that was not initially planned.

Alignment efforts AS2 and AS3 emerged from an idea of the local managers of some PCC groups of network 5, and were implemented by them. Nevertheless their implementation required the agreement of implementation managers (of the RHA) and managers of the local hospital. These are examples of alignment efforts that were not initiated by implementation managers but were a result of a natural evolution of the implementation project.

3.4.1.1.4 AS4 – Adoption of a complementary technology

Although alignment effort AS4 was observed in network 2, it would have an impact in all the other networks that were served by network 2's exam reading capability. The effort consisted of the implementation of a complementary technology to improve the efficiency of the readings. The implementation managers were still looking for an adequate solution for this effort by the end of our fieldwork, but they had a clear intention of going through with it.

In network 2, the lack of reading capacity (capacity misalignment MC1) could be partially addressed if some of the readings were performed automatically with appropriate software (the complementary technology). Such software could produce the reports for the most obvious cases (obvious need for treatment or no treatment) and the readers (ophthalmology physicians) would process the remaining cases. Although this software would still have to be monitored frequently by the readers, to check its performance (double checking randomly selected reports), implementation managers believe it would significantly reduce the readers'

3.4. Efforts to align network and technology

workload. This would be a structural alignment of the screening program, the inclusion of a new system that would perform part of the readers' work, lowering their workload and solving (at least partially) the capacity misalignment. However, as previously mentioned, this structural alignment had not yet been implemented by the end of our fieldwork, essentially because the implementation managers had not found any software capable of performing this task with (the quality of) the images provided by the screening machines.

3.4.2 TECHNICAL ALIGNMENT EFFORTS

During an implementation process, in order to improve its outcome, the technology must be aligned with the network's technical context ([Cagliano et al., 2005](#), [Danese et al., 2006](#), [Hartmann et al., 2009](#), [Hinkka et al., 2013](#), [Loebbecke, 2007](#), [Rivera and Rogers, 2006](#), [Tan et al., 2010](#)), and the interorganizational technical setting must be aligned with the appropriate setting to use the technology ([Alin et al., 2013](#), [Angeles, 2008](#), [Chan and Swatman, 2000](#), [Dominguez-Péry et al., 2013](#), [Gharavi et al., 2004](#), [Power and Singh, 2007](#), [Rajaguru and Matanda, 2013](#), [Shaik and Abdul-Kader, 2013](#), [Tan et al., 2010](#)). Technical alignment efforts, therefore, involve changes in the network's technical setting ([Alin et al., 2013](#), [Dominguez-Péry et al., 2013](#), [Neubert et al., 2011](#), [Power and Singh, 2007](#)) and the technology's functionalities ([Dominguez-Péry et al., 2013](#), [Neubert et al., 2011](#)).

In the network, technical alignment efforts may involve changing its business processes (rules or work practices), knowledge basis and related capabilities, means and flows of information sharing, or existing systems ([Alin et al., 2013](#), [Angeles, 2008](#), [Chan and Swatman, 2000](#), [Croom, 2005](#), [Dominguez-Péry et al., 2013](#), [Fosso Wamba et al., 2007](#), [Gharavi et al., 2004](#), [Henderson et al., 2012](#), [Kurnia and Johnston, 2000](#), [Neubert et al., 2011](#), [Power and Singh, 2007](#), [Rajaguru and Matanda, 2013](#), [Shaik and Abdul-Kader, 2013](#), [Shin, 2006](#), [Sigala, 2013](#), [Tan et al., 2010](#)). The changes to the business processes may consist of the elimination of obsolete tasks, the automation or simplification of other tasks, and the creation of new tasks or processes ([Croom, 2001](#), [Fosso Wamba et al., 2007](#), [Kurnia and Johnston, 2000](#), [Loebbecke, 2007](#), [Shaik and Abdul-Kader, 2013](#), [Shaw and Holland, 2010](#)). In addition to business process alignment, the organizations in the network may have to change their existing systems to improve data quality, provide acceptable levels of data, and provide accessibility to enable integration with the technology ([Power and Singh, 2007](#), [Shaik and Abdul-Kader, 2013](#)). They may also have to adapt their knowledge basis to

become compatible with the changes of the business processes ([Alin et al., 2013](#), [Angeles, 2008](#)).

On the technology side, technical alignment efforts consist of changes to the implemented modules, to allow their integration with existing systems, or the incorporation or creation of required functionalities ([Angeles, 2008](#), [Chan and Swatman, 2000](#), [Croom, 2005](#), [Dominguez-Péry et al., 2013](#), [Fosso Wamba et al., 2007](#), [Hinkka et al., 2013](#), [Neubert et al., 2011](#), [Shaw and Holland, 2010](#), [Wakerman et al., 2005](#)). The technology should be adapted not only to integrate with existing systems, but also to fit the network's performance requirements ([Loebbecke, 2007](#), [Shaw and Holland, 2010](#)).

The match between the technical alignment efforts found in the literature and those found through case research is represented in Table 3.8.

3.4.2.1 INSTANCES OF TECHNICAL ALIGNMENT EFFORTS

Eight technical alignment efforts were observed in the case research, that we call AT1 through AT8 (Table 3.7). Alignment effort AT1 refers to changes in business processes rules. AT2 and AT3 are respectively related to changes or the creation of work practices in the business processes. AT4 consists of changes to the existing systems and AT5 of their integration with ScreenSoft. In AT6, the creation of work practices provides a new means of information sharing among organizations in the network. AT7 refers to changes in the functionalities of the screening program (i.e., changes in the supporting systems of the screening program). AT8 consists of the creation of new functionalities in the screening program, specifically in its ScreenSoft software.

3.4.2.1.1 AT1 – Change of business process rules

AT1 consists of the adaptation of business process rules, and was observed in networks 1, 4, 5, 6, 7, and 8.

In network 1, when the screening was centralized in one PCU (structural alignment effort AS1), the responsibility for the scheduling, which used to rotate among the secretaries of the PCUs where the screening was carried out, was also centralized. This allowed the formalization and standardization of scheduling rules, which previously depended on the secretary. Some scheduling rules that were previously possible, such as rescheduling patients who failed an appointment, became unfeasible due to workload constraints. In the case of

3.4. Efforts to align network and technology

rescheduling, the secretary decided that the patients had to call in advance to cancel the appointment and reschedule a new one, otherwise they would fail their opportunity to be screened in that round. In addition, a careful analysis of patients' behaviour and complaints, which also became possible due to centralization, led to the definition of new rules. For instance, appointments started to be organized by phone number to guarantee that couples were scheduled together, which most of them preferred.

Still in network 1, some patients did not have adequate transportation services to travel to the local hospital (structural misalignment MS2), particularly because of very limited traveling timetables. Because this structural misalignment was caused by local context conditions (the definition of the population served by the hospital is outside the scope of the screening program) its solution could not be a structural alignment. Consequently, to reduce the misalignment's impact the local hospital adapted its business process rules, actually once again its scheduling rules: in order to reduce the number of visits to the hospital, treatment sessions were grouped in the same appointment as much as possible (for instance, the first exam was also scheduled for the first appointment, instead of a later time).

In network 4, the orthotic technicians decided to accept extra patients. However, unlike other networks where the extra patients were received *ad hoc*, because the technicians were dedicated only to that task, in this network the screening was performed in the local hospital, and the technicians had to integrate them in their daily plan. Accordingly, it was decided that the extra screenings had to be scheduled by the PCU secretary in two available time slots per day. A new scheduling rule, thus, was created in order to adequately integrate the workload of the screening program with their remaining work at the hospital, and make sure that all the planned screenings (including the two extra daily appointments) could be performed.

In network 5, in order to reduce the delay caused by the increased workload and decreased number of professionals (capacity misalignment MC1), the ophthalmology physicians decided to stop accepting rescheduling requests. This freed up later screening appointments in the rounds due to the elimination of duplicate appointments, which became shorter, requiring less capacity.

In network 6, once the professionals realized the lack of capacity of the reading centre to perform the readings on time (capacity misalignment MC1), they decided to reduce the number of screenings performed per day. This alignment effort in the scheduling rules was

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

found to have low impact on the screening times (targets) and reduced the amount of work sent to the reading centre, thus also reducing the reading capacity required.

In network 7, the technicians had limited time available to perform the screening (capacity misalignment MC1), and proceeded to change some work practice rules to stop accepting patients that went to the PCU in a day other than that of their appointment. With this technical alignment, the technicians became capable of performing all the screenings planned for each day, and avoided duplicate appointments (patients scheduled for one day who had already performed the screening or who would perform the screening in a following day).

In network 8 the population was very spread and several patients had difficulties traveling to the locations of the screening (structural misalignment MS2). After observing the behaviour of some of those patients, the PCC group managers decided to change the organization of the scheduling and group patients from the same village, i.e., schedule those patients in subsequent screening slots. This allowed the patients to start sharing transport, which was expected to increase their participation in the screening.

3.4.2.1.2 AT2 – Changes in work practices

Alignment effort AT2 was observed in networks 1, 2, 4, 5, and 8, and includes four different changes to work practices. In networks 1 and 4 ophthalmology physicians stopped discharging some patients after the treatment was concluded; in networks 1 and 8 ophthalmology physicians decided to include a repetition of the screening exam in the first appointment of the patients that were starting treatment; in networks 2 and 5 some GPs started referring patients for screening using the old system, instead of including them in the screening program; and, in networks 4 and 5 a more complete screening exam was made possible by the fact that the screening was centralized in the local hospitals.

Ophthalmologist physicians of the local hospital of network 1 changed their *modus operandi* at the end of treatment sessions for more severe patients (who later might require further treatment) due to the delays caused by the lack of resources of the reading centre (capacity misalignment MC1). They stopped discharging those patients, keeping them in routine appointments in the hospital, instead of sending them back to the screening program as defined by the screening process (technical alignment of work practices). This way, ophthalmology physicians could avoid that those patients took too long to come back to treatment if needed and risk becoming untreatable. Similarly, in network 4, due to the delays

3.4. Efforts to align network and technology

created by the lack of resources (capacity misalignment MC1), some patients were not discharged after being treated, because some for ophthalmologist physicians they should remain monitored by the hospital physicians and not go back to the screening program, risking taking too long to be sent back for treatment.

The patients sent for treatment had a classification of priority, related to the urgency of treatment. In some cases, ophthalmology physicians of network 1 detected that the priority classification was not correct and the exam had to be repeated before any decision could be made, because the images of the exam performed during the screening did not have sufficient quality. For this reason, the structure of first appointments was modified to include a more detailed screening exam, under better conditions that allowed correcting the diagnosis whenever needed. In network 8 ophthalmologist physicians did not have access to the images of the screening exams, in this case because the local hospital did not have a PACS – Picture Archiving and Communications System (technical misalignment MT2), so they also decide to include one in every first appointment, to perform a first evaluation of the patient.

In network 2 the first round of the screening took longer than planned because PCC group 2-a was merged with another PCC group that was not previously part of the network. The existing technicians were not able to accommodate the increase in number of patients, and the insufficient capacity resulted in delays, and the inability to meet the time targets of the screening program. As the second round of the screening was taking too long to start, the managers of the other PCC group (2-b) recommended to their GPs the referral of patients to a general ophthalmology appointment in the hospital with a request to screen the retinopathy, which used to be the practice prior to the implementation of the new screening program. This technical alignment had a negative impact on the routinization of the screening in PCC group 2-b. The number of patients called for the screening decreased significantly from the first to the second round (from 8 686 to 5 790), as can be observed in . Similarly, in network 5, due to the delays caused by the increased workload and decreased number of professionals in the ophthalmology centre (capacity misalignment MC1), some GPs also began to refer their patients to ophthalmology appointments to perform the screening.

In networks 4 and 5, as a consequence of the centralization of the screening in the local hospitals (structural alignment effort AS1), a more complete exam could be implemented, including health conditions that were not included in the screening program's plan. This technical alignment was created to take advantage of the better technical conditions offered

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

by the local hospitals to perform the exam (more, and more qualified, staff, appropriate rooms, and better machines) when compared to the conditions offered by the PCUs.

3.4.2.1.3 AT3 – Creation of new work practices

Alignment effort AT3 was observed in networks 1, 2, 3, 4, 5, and 7, and consists in the creation of new work practices to collect information about patients before deciding to include them in the screening or not (networks 1, 2, and 3), to check whether patients were already being treated in the local hospital before calling them to initiate a new treatment (networks 1, 2, 3, 4, and 7), or to create a moment of negotiation of screening slots for the following round, according to the transportation availability (network 5).

Some of the patients sent for treatment through the screening program were already being treated or followed in the local hospitals by the ophthalmology service (technical misalignment MT1), usually because they had been previously sent to the hospital for another reason, the retinopathy had been detected and they had started treatment. This was happening either because the GPs did not have information about which patients were being followed in the local hospital, and thus could not consider it in the selection of the patients to include in the screening program, or because they encouraged the participation in the screening, regardless of whether the patients were being monitored or treated in an ophthalmology service (in some cases due to instructions of the PCC group management), or because the patients that were not allocated to a GP were directly included in the screening program without previous triage. As a consequence, when those patients were sent for treatment, there was a duplication of appointments in the local hospitals. In order to optimize the selection process, in network 1 the primary care secretaries started to collect this information when they called the patients and when the patients visited the PCU. In network 2 the secretaries created a list of patients that did not come to the first round of the screening, for which GPs and secretaries investigated the reasons. This allowed them to exclude the patients that were already being monitored or treated in ophthalmology services from the second round of the screening. In network 3, prior to their screening appointment, some patients informed the primary care secretary that they had retinopathy and that they were already being treated. In those cases, the primary care secretary cancelled the appointment. However, some problems remained because those patients were reinserted in the list of patients to be selected by the GP, and could be called again in the same round.

3.4. Efforts to align network and technology

Back in network 1, when the local hospital started to accept patients from the screening program after a pause of over one year, besides the massive delay, there was a lack of treatment capacity to respond in time to the long waiting list (capacity misalignment MC1), a situation that would persist for a long time without a temporary alignment effort. To reduce the long waiting list faster, hospital managers decided to create a new work task for the ophthalmology service secretaries, to check whether each patient in the list was already being treated in the hospital or not. Hospital secretaries then started to filter the patients before scheduling them: patients already being treated were not scheduled and were excluded from the waiting list. This new work practice was kept even after eliminating the initial misalignment and the waiting list, because it improved the performance of the treatment scheduling business process. In networks 3 and 4 the same alignment effort was carried out to avoid the duplication of appointments, as mentioned previously. The clinical secretaries of the local hospitals checked whether patients were already being monitored or treated in the hospital before scheduling them for treatment, and if so they did not schedule them and excluded them from the list of patients to be treated. Similarly, in networks 2 and 7, in the first treatment appointment, the ophthalmology physician would inquire whether the patient was being followed in the ophthalmology service in that hospital or in another hospital, and if so discharged the patient.

In network 5, the lack of transportation capacity (capacity misalignment MC2) from the new members of the network (municipalities) with the responsibility for the transportation of patients from the PCU to the local hospital (structural alignment effort AS2), triggered the alignment of the screening scheduling plan (time window and number of daily scheduling slots) with vehicle availability (technical misalignment MT4). In each round of the screening, the RHA started to inform the PCC group sooner than usual about the dates of the screening round, in order for the PCC group managers to have time to negotiate the screening scheduling slots with the municipalities and the ophthalmology centre – this negotiation was also a new work practice, that was not part of the initial process (the scheduling slots were defined by the RHA). During the negotiations the scheduling slots were defined, and later communicated to the software provider to be included in ScreenSoft, the latter step already considered in the initial plan.

3.4.2.1.4 AT4 – Change of existing systems

In alignment effort AT4, observed in network 5, the existing systems were modified, in this case the system used by the RHA to evaluate the PCUs.

In network 5, as previously mentioned, in order to reduce the delay caused by the increased workload and the decreased number of professionals (capacity misalignment MC1), the ophthalmology physicians decided to stop accepting requests for rescheduling patients (technical alignment effort AT1). This adaptation had the drawback of not making sure that every patient was screened, which may explain the decline in participation observed in PCC group 5-a from the second to the third screening round (). As a consequence, some Key Performance Indicators (KPIs) related to the screening program (the number of patients screened in each round and the duration of each screening round) were removed from the contract between the RHA and the PCC groups, because PCC groups were being misevaluated due to local hospital decisions. However, removing those KPIs also removed their contribution as a mechanism of motivation for the GPs to participate in the screening program, hurting the routinization of the screening. This may explain the decrease in the number of patients selected for screening from the second to the third round in PCC group 5-a, as a reflection of a reduced participation from GPs ().

3.4.2.1.5 AT5 – Integration of screening with existing systems

Alignment effort AT5 was observed in network 4 and refers to the integration of the technology supporting the screening program (ScreenSoft) with the existing systems in the network.

In network 4, due to the decision to centralize the screening in the local hospital (structural alignment effort AS1), ScreenSoft had to be integrated with the software that the local hospital was using in the ophthalmology service, which we will call OphthalSoft. Because OphthalSoft was more complete than ScreenSoft, the former was preserved and integrated with the latter, so that the PCUs could use the latter. In this network ScreenSoft supported only the activities of the PCUs and information sharing among the organizations in the network, in particular with the local hospital and with the RHA.

3.4. Efforts to align network and technology

3.4.2.1.6 AT6 – Creation of new work practice to provide new means of information sharing

Alignment effort AT6 was also observed in network 4, and is concerned with the creation of a work practice that enabled a new means of information sharing between the organizations in the network.

In order to avoid patients already in treatment in the local hospital being sent to treatment through the screening program, with a duplication of appointments (technical misalignment MT1), the local hospital start to provide the RHA a yearly report with the list of patients being monitored and treated for diabetic retinopathy. The local hospital aimed at creating a new formal channel of communication with the GPs, to share that information and avoid the inclusion of those patients in the screening program. By the end of our fieldwork, the initiative was not yet being effective because that information was still not getting to the GPs, and patients who were already being treated at the local hospital were still being sent for treatment through the screening program.

3.4.2.1.7 AT7 – Changes in functionalities of the screening program

In alignment effort AT7, observed in networks 4 and 5, the screening program was modified, its ScreenSoft component in network 4, and a means of information sharing in network 5.

In network 4, as already mentioned, the hospital technicians decided to accept two extra patients per day for screening (technical alignment effort AT1). However, when ScreenSoft was adapted to allow the scheduling of extra slots, the setting of a limit on their number was not included. Consequently, the secretaries of the PCUs sometimes scheduled more than two extra patients for the same day, exceeding the available technicians capacity and contributing to a global delay of the screening. The technicians then requested the inclusion of the limit, and the problem was resolved.

In network 5, structural alignment effort AS2 (the inclusion of municipalities in the network to provide transportation services for patients from the PCUs to the local hospital) created a misalignment of knowledge basis, because transportation information (place and time of departure) was not included in the letter inviting the patients for the screening. This required the creation of a new template to include that information that was promptly made available by the providers of ScreenSoft.

3.4.2.1.8 AT8 – Creation of new functionalities in the screening program

Alignment effort AT8 was observed in network 2, but it also had an important impact on networks 1, 3, 6, 7, and 8, for which the reading centre of network 2 provides the exam reading service. The effort consisted of the inclusion of new functionalities in ScreenSoft to increase the efficiency of reading tasks.

The reading centre, located in network 2, faced several difficulties to meet the reading time established by the screening process, due to lack of resources (capacity misalignment MC1). To solve that capacity misalignment, more ophthalmology physicians were assigned to the reading of the exams (capacity alignment effort AC1) and ScreenSoft was changed to allow those physicians to perform the readings remotely, using a virtual private network (VPN) connection. This technical alignment of ScreenSoft allowed the professionals to allocate more of their time to the readings, in particular when they were not at the hospital.

The capacity misalignment could also be partially reduced, at least for the patients with a more immediate need for treatment, if the technicians could share with the reader their perceptions about the urgency of treatment (technical misalignment MT3). This technical misalignment was observed in networks 1, 2, 3, 6, and 7, i.e., all the networks in which the reading centre provided the reading service but one (network 8, in which the collected data were scarcer).

The technical misalignment was overcome in 2013 with the introduction of a new functionality in ScreenSoft, which allowed technicians to associate information on the perceived urgency of treatment to the exam. This technical alignment reduced the impact of reading delays, because most patients with an urgent need for treatment started to be sent to the local hospital on time. This technical alignment effort was implemented in networks 1 and 2 even before the functionality was available on ScreenSoft, through improvised efforts to transmit the information (perceived urgency of treatment) to the readers, using a formal communication channel in network 1 and an informal (direct) one in network 2, both new work practices. In network 1, the technicians communicated the urgent cases to the PCC group director, who would then transmit them to the implementation manager at the RHA, who in turn would send it to the ophthalmologist physicians who read the exams. In network 2 the technicians communicated the urgent cases directly to the ophthalmologist physicians who read the exams, because they shared the same network and the same hospital. These improvised technical alignments were actually what drew the attention of professionals and

3.4. Efforts to align network and technology

managers, implementation managers in particular, to the new technical misalignment and to its final solution (the new functionality for ScreenSoft).

3.4.3 CAPACITY ALIGNMENT EFFORTS

Capacity alignment efforts involve changes in network capacity, i.e., changes in the number of resources available ([Dominguez-Péry et al., 2013](#), [Meyers et al., 2012](#), [Power and Singh, 2007](#)), essentially by “hiring” more resources to overcome any lack of capacity (capacity misalignment). Similar to the capacity misalignment, capacity alignment efforts are also closely related to technical alignment efforts. However, capacity alignment efforts involve changes in the number of resources dedicated to the implementation project, whereas technical alignment efforts involve changes to what the resources do, or to how they perform their tasks.

The match between capacity alignment efforts found in the literature and those found through case research is represented in Table 3.8.

3.4.3.1 INSTANCES OF CAPACITY ALIGNMENT EFFORTS

Two capacity alignment efforts, that we will call AC1 and AC2 (Table 3.7), were observed in the case research. In AC1, the capacity was increased by hiring more professionals to perform a business process, and in AC2 other resources were increased, namely the number of screening scheduling slots available on each round.

3.4.3.1.1 AC1 – “Hire” more professionals

Alignment effort AC1 was observed in networks 1, 2, 4, 6, and 8, and involved a capacity increase in some business processes, through the hiring of more professionals: hospital secretaries in network 1, ophthalmology physicians in networks 2 and 4, technicians in network 6, and primary care secretaries in network 8.

In network 1, as previously mentioned, hospital secretaries started to filter patients before scheduling them (technical alignment effort AT3). This technical alignment effort created a new capacity misalignment: there were not enough secretaries to perform the task on time while still performing all other duties (capacity misalignment MC1). For this reason, an extra team of secretaries was assigned to help perform the crosschecking, which increased local capacity and solved the capacity misalignment.

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

In network 2, the reading centre had several difficulties meeting the targets for reading time established by the screening process, due to lack of resources (capacity misalignment MC1). To solve that capacity misalignment, more ophthalmology physicians were assigned to read the exams and ScreenSoft was changed to allow the physicians to perform the readings remotely, using a virtual private network connection (technical alignment effort AT8).

As mentioned previously, in the local hospital of network 4 the outpatient appointments with more operational difficulties were the retina appointments. The resulting insufficient number of professionals available for the screening led to a delay in both readings (taking three months instead of the one month target) and beginning of treatments (taking about 100 days to start treatment instead of the 30 days target). These delays were eliminated when more ophthalmologist physicians were hired for the service.

In network 6, in the first round several technicians were sent from the hospital to the PCUs to perform the screening. Those technicians, however, were also needed back at the local hospital, and after some time a technician had to be hired to be exclusively dedicated to the screening. The remaining technicians were released and went back to being fully dedicated to the hospital care.

In network 8, in the beginning of the screening program there was a lack of primary care secretaries to perform the screening tasks (capacity misalignment MC1). To overcome that misalignment the management of the PCC group created a new team of primary care secretaries to support the tasks of the screening program (schedule and call patients).

3.4.3.1.2 AC2 – Change number of screening slots per round

Alignment effort AC2 was related to the definition of the number of scheduling slots available for each round of the screening program, i.e., the definition of screening capacity per day, and was observed in network 5.

For the alignment between the schedules of the screening and the vehicle to be possible, in each round of the screening the PCC group managers negotiated the screening scheduling slots with the local municipalities and the ophthalmology centre (technical alignment effort AT3), which in turn conditioned the number of patients screened per day and, therefore, the duration of each round.

3.5 DISCUSSION

As mentioned in the introduction, to the best of our knowledge very few classification schemes have been proposed so far for misalignments and alignment efforts, and none have diffused significantly among implementation management researchers. This makes it difficult to compare findings from different studies and to build new knowledge based on those findings. With this motivation, in this paper we propose classification schemes for misalignments and alignment efforts using four major classes – context, structural, technical, and capacity – the first not applicable to alignment efforts.

Although our case research addresses implementations in networks of organizations, we also examined the literature on implementations in single organizations, expecting to find similar misalignments and alignment efforts, though likely of a simpler nature.

Based on empirical findings from the case research, we propose that context misalignments consist of a lack of compatibility between the technology and the initial operational context of the network. Unlike the other classes, they are identified proactively, at the beginning of the implementation or even before its beginning, by comparing the local operational context with the context expected for using the technology, and may trigger structural, technical or capacity alignment efforts in the network or in the technology.

Although context misalignments were found to be scarce in the literature and can in fact be included in the other three classes of misalignments, the authors decided to assign them a separate class, because they originate in a distinct characteristic of the operational context of the adopter that makes it stand closer or farther from the planned operational setting for the use of the technology. The existence of this distinct characteristic makes the proactive identification of these misalignments possible. In the case studies, network 4 had an operational context closer to the operational setting planned for the implementation of the screening program, because it already had a local screening program, even if with differences in the structural configuration, which was addressed by small changes in the structures of the new screening program and the network. The operational context of network 5, in turn, was more distant, because the network had a new local ophthalmology service with abundant human resources and equipment capacity, ready to be filled with patients. In this network there was no prior screening program, and the operational conditions were more favourable to a centralized screening in the local ophthalmology centre than a decentralized one in the PCUs, as planned in the screening program.

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

Based not only on our empirical findings, but also on the findings from the literature review, we propose that structural misalignments and structural alignment efforts consist, respectively, of a lack of compatibility, or efforts to create compatibility, between the modules of the technology and the organizations in the network, along the following dimensions: number of modules and organizations; connections between modules and relations between organizations; workflow sequence defined for the modules of the technology and for the business processes of the network; and the assignment of modules to organizations in the network (work allocation). From other frameworks proposed in the literature, this classification corresponds to structural misalignments or alignments ([Alin et al., 2013](#), [Power and Singh, 2007](#), [Rajaguru and Matanda, 2013](#), [Sackey et al., 2015](#), [Shaw and Holland, 2010](#), [Taylor and Levitt, 2007](#)) and to delivery system misalignments and adaptation cycles ([Leonard-Barton, 1988a](#)). It can also include some of the technology alignments proposed by [Sackey et al. \(2015\)](#) and to some process alignments proposed by [Power and Singh \(2007\)](#) and [Shaw and Holland \(2010\)](#). Structural alignment efforts may be implemented in both the network of organizations and the technology.

Technical misalignments and technical alignment efforts concern, respectively, a lack of compatibility, or the efforts to create compatibility between the technology's functionalities and features and the network's technical setting, which includes work practices, business process rules, knowledge basis and related capabilities, means and flows of information sharing, and existing systems. They correspond to the task and actor alignments proposed by [Sackey et al. \(2015\)](#), the technical and value misalignments, and technology development and performance criteria adaptation cycles proposed by [Leonard-Barton \(1988a\)](#), the system alignments proposed by [Power and Singh \(2007\)](#) and [Rajaguru and Matanda \(2013\)](#), and to process alignments proposed by [Shaw and Holland \(2010\)](#) and [Rajaguru and Matanda \(2013\)](#). This class can also include some of the technology alignments proposed by [Sackey et al. \(2015\)](#) and some of the process alignments proposed by [Power and Singh \(2007\)](#). Technical alignment efforts may be implemented in both the network of organizations and the technology.

Finally, capacity misalignments and capacity alignment efforts are, respectively, related to the lack of compatibility, or the efforts to create compatibility, between the resources available for the implementation project and the resources required to take full advantage of the technology's potential. They correspond to the efforts to align the resources dedicated to

3.5. Discussion

the implementation referred by [Dominguez-Péry et al. \(2013\)](#) and [Kurnia and Johnston \(2000\)](#). Capacity alignment efforts are implemented in the adopter.

Identifying misalignments

Some structural, technical, and capacity misalignments can be represented visually for purposes of alignment effort planning. Structural misalignments may be assessed through the comparison of matrices that represent the systemic complexity of the technology and the structure of the network. Design structure matrices (DSM) ([Steward, 1981](#)) may be a useful tool for that purpose. They represent the interactions between the functional modules of the technology and between the organizations in the network, and the comparison of the two matrices may highlight the need for new organizations to join the network, or to create new connections between organizations, or the need to implement new modules in the technology or adopt complementary technologies. This analysis is useful to assess how adequate the network structure is to use the technology ([Alin et al., 2013](#), [Leonard-Barton, 1988a](#)). However, such matrices should not be seen as a sufficient means for identifying structural misalignments, because difficulties created by the structure of the network such as the misalignments identified in the case research (MS1 and MS2), for instance, can not be identified through those representations.

Matrices may as well represent technical misalignments related to the existing capabilities in the network. Inspired by research on misalignments in complex product development ([Sosa et al., 2004](#)) a matrix that maps the relations between technology functionalities and the capabilities required to use them can be compared with a matrix mapping the capabilities – knowledge-rooted organizational processes and routines ([Cepeda and Vera, 2007](#)) – of each organization in the network, to identify the capabilities that are missing in the network and will have to be developed. These matrices are valuable to identify knowledge basis misalignments, but again, should not be seen as a sufficient means for identifying technical misalignments, because they do not allow the identification of other types of technical misalignments.

Finally, in a similar way to technical misalignments, capacity misalignments may be identified by comparing matrices mapping the number of resources required to use each module of the technology and the number of resources available in each organization for the implementation, whenever the number of resources needed to use each module of the technology can be predicted.

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

Relations between misalignments and alignment efforts

The impact of misalignments on the performance of the adopter and the efficiency of the implementation may be mediated by alignment efforts decided by implementation managers. However, alignment efforts may result from misalignments identified by other actors, which may inspire or require one or more specific alignment efforts to reduce negative impacts or enhance positive impacts on the implementation's outcomes. For example, alignment efforts AS2 and AS3 emerged from an idea of the local managers of some PCC groups of network 5, and were implemented by them, but their implementation required the agreement of the (RHA) implementation managers and the managers of the local hospital.

The alignment efforts required to overcome misalignments are important to address barriers to technology assimilation ([Greenhalgh et al., 2004](#), [Rogers, 2003](#)). The implementation of alignment efforts, usually both in the adopter and in the technology, results in an operational setting of the adopter closer to the one required to use the technology, and in a technology configuration closer to the existing operational setting in the adopter, with positive impacts on the routinization and incorporation of the technology, and therefore on implementation success ([Darbanhosseiniamirkhiz and Wan Ismail, 2012](#)).

The most obvious relation to expect between misalignments and required alignment efforts would be for them to belong to the same class. However, the case research reveals that this is not always the case and structural misalignments may lead to technical alignment efforts (for instance, structural misalignment MS2 led to technical alignment effort AT1), technical misalignments may lead to capacity alignment efforts (for instance, technical misalignment MT4 led to capacity alignment effort AC2), and capacity misalignments may lead to structural and technical alignment efforts (for instance, capacity misalignment MC1 led to structural alignment effort AS4 and to technical alignment efforts AT1, AT2, AT3, AT4, and AT8). The relations between classes of misalignments and alignment efforts are not always linear, in the sense that a misalignment of one class does not necessarily lead to an alignment effort of the same class. Future research could further examine the non-linear logic of these sequences of alignment.

3.6 CONCLUSION

This paper contributes to the implementation management literature, proposing classification schemes for misalignments and efforts of alignment between the technology and its adopters during implementation projects. The classification schemes aim at helping systematize the presentation of findings in future research on this topic, increasing the comparability of results of different studies, and facilitating the creation of new knowledge based on previous findings. The four classes proposed – context, structural, technical, and capacity – have been developed based on a multiple case research, inspired by and tested with a literature review. Future research is required to test the classification schemes proposed with broader data sets, namely using quantitative research.

The proposed classification schemes are focused on the operational alignment challenges of the implementation project. Other equally important dimensions of alignment, such as cultural alignment ([Rivera and Rogers, 2006](#), [Wakerman et al., 2005](#)) or strategic alignment ([Dominguez-Péry et al., 2013](#), [Henderson and Venkatraman, 1993](#), [Neubert et al., 2011](#)) were not considered in this study. Future research could extend these classification schemes to include other dimensions of alignment.

Some types of structural, technical, and capacity misalignments may be represented by matrices, as suggested by researchers studying misalignments in complex product development. Those representations may further increase the systematization of misalignments and alignment efforts, and are, therefore, important contributions for the practice of implementation management. However, they only are able to represent some of the identified misalignments, and hence are not sufficient to address misalignments in an implementation project. Another suggestion for future research would be to find other forms of representation that suit other types of misalignments that cannot be represented by matrices, in order to build a complete framework for the identification of misalignments.

The relations between misalignments and the alignment efforts that they trigger are not always linear. Although it might be expected that a misalignment of one class, such as structural misalignment, would trigger an alignment effort of the same class, a structural alignment effort, that is not always the case. In some cases, a misalignment of one class leads to an alignment effort of another class. The identification of these non-linear sequences of alignment reveals the existence of several possibilities of resolution for a same misalignment, and also that the proposed classes are interconnected, as [Sackey et al. \(2015\)](#) also suggest.

3. Classification schemes for misalignments and alignment efforts during technology implementations in networks

Future research could investigate what triggers non-linear sequences of alignment, how they are managed during the implementation process, and what are their consequences for the implementation process and outcomes.

As observed in some of the findings of the case research (misalignments MS2, MT1, and MC1), misalignments have an influence on the outcomes of the implementation. The success of an implementation can be evaluated by its outcomes, whose evolution should be monitored during the implementation process for purposes of adjustment of goals or performance criteria ([Klein and Sorra, 1996](#)). Implementation outcomes include the efficiency of the implementation process, i.e., the level of routinization and incorporation of the technology in the network ([Hameed et al., 2012](#), [Klein and Sorra, 1996](#)), and the impact of the technology in the performance of the network, i.e., the level of performance enhancement ([Klein and Sorra, 1996](#)). Misalignments may have an impact on both dimensions ([Wei et al., 2005](#), [Wu et al., 2007](#)). An important future research direction is, therefore, the study of whether different classes of misalignments and different sequences of alignment may have different impacts on each of the multiple dimensions of implementation outcome.

Several considerations may contribute for the practice of implementation management. As a first main point, in an initial utilization stage, a new technology might be outperformed by existing operations due to misalignments between the technology and the adopter, because the processes required to use the technology are not yet completely incorporated in the operational routines of the adopter. Another general point to consider when analysing and evaluating the impact of misalignments is the fact that some may be beneficial to the network, e.g., when they bring a higher systematic order into the operations. Managers should have a sense of the adopter's structure, technical setting, and capacity in place at the beginning of the implementation to compare them with those needed to use the technology, and identify misalignments as soon as possible. A good and early understanding of the characteristics of the technology and the adopter will enable managers to better evaluate the need for alignment efforts in any or both, and thus better plan the implementation process.

3.6. *Conclusion*

4 SEQUENCES OF ALIGNMENT BETWEEN TECHNOLOGIES AND ADOPTERS: CASE RESEARCH OF IMPLEMENTATIONS OF A NEW HEALTH SCREENING PROGRAM

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ABSTRACT

Although the study of implementations of technologies as processes of mutual adaptations or sequences of alignment has long been an established field, its extension to contexts with networks of organizations as a locus of adoption has only recently started to see some development.

Misalignments between technologies and adopters, i.e., the lack of compatibility between them that generates the need for alignment efforts, are a major cause of productivity losses in early stages of implementation projects. Alignment management is particularly challenging when the adopter, instead of a single organization, is a network of organizations, a setting that is becoming increasingly important as a key organizational structure in many industries, such as healthcare.

Findings from a multiple case research of the implementations of a new health screening program in networks of healthcare providers in the North of Portugal support a specific

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4.1. Introduction

conceptualization of alignment efforts for networks of adopters, and provide an improved understanding of how these efforts are sequenced. Two particular sequences of alignment are explored: non-linear, and cascading.

This work contributes to the body of knowledge of an important, yet understudied, topic in technology management, and provides guidelines to help managers achieve higher levels of performance in technology implementation projects, by addressing why non-linear and cascading sequences occur, what their impacts on implementation projects are, and how they should be managed.

4.1 INTRODUCTION

The conceptualization of implementations of technological innovations as sequences of alignment has now been established for a few decades. Such implementations face initial losses of productivity mainly due to misalignments between the technology and its adopter ([Basoglu et al., 2007](#), [Leonard-Barton, 1988a](#), [Wei et al., 2005](#), [Wu et al., 2007](#)), which usually lead to a dynamic sequence of mutual adaptation efforts between them ([Alin et al., 2013](#), [Choi and Moon, 2013](#), [Leonard-Barton, 1988a](#)). Mutual adaptations ([Leonard-Barton, 1988a](#)), or sequences of alignment ([Neubert et al., 2011](#)), are thus an important challenge for implementation management ([Bhattacharya, 2012](#)).

Networks of organizations are particularly challenging settings for the implementation of technologies, due to the need to orchestrate decisions between multiple organizations ([Dhanarag and Parkhe, 2006](#), [Goes and Park, 1997](#)) and to the fact that the dynamics of network evolution depend not only on the individual organizations, but also on their mutual alignment ([Hung et al., 2011](#), [Taylor, 2005](#)). Networks have an increasing importance in contemporary economies, and in particular case of the healthcare industry they are fundamental vehicles for clinical improvement ([Cunningham et al., 2012](#), [Gittel and Weiss, 2004](#)), namely through the delivery of integrated care ([Evans and Baker, 2012](#)).

Technological solutions are fundamental for the operations of the networks, in particular because they support the interactions between their organizations. For example, networks of healthcare providers have been adopting electronic health records and evidence-based practices to support the above-mentioned delivery of integrated care ([Aarons et al., 2011](#), [Barlow et al., 2006](#), [Palinkas et al., 2014](#), [Sicotte et al., 2006](#)). The full realization of the potential of new technological solutions requires a good understanding of their

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

implementation processes, which are critical for the assimilation of the technology in the routine operations of the adopter ([Greenhalgh et al., 2004](#), [Leonard-Barton, 1988a](#), [Linton, 2002](#), [Rogers, 2003](#)).

In the context of implementation projects, misalignments between a technology and the network of organizations adopting it result from a lack of compatibility between both ([Alin et al., 2013](#), [Choi and Moon, 2013](#), [Leonard-Barton, 1988a](#)). Accordingly, alignment, which is theorized to be a state that can be achieved through an alignment process ([Hanson et al., 2011](#)), can be reached through changes to the technology and to the network with the objective of increasing the compatibility between both. These alignment efforts are expected to require adaptations in the technology's structure and functionalities and in the network's structure, technical setting, and capacity ([Power and Singh, 2007](#), [Shaw and Holland, 2010](#)). Therefore, and based on the literature, they may be classified in structural, technical, and capacity alignments:

- *Structural alignments* involve changes in the structure of the network, including changing work allocation among organizations of the network ([Alin et al., 2013](#), [Dominguez-Péry et al., 2013](#), [Neubert et al., 2011](#), [Power and Singh, 2007](#)) or changing the organizations in the network and their relations ([Danese et al., 2006](#), [Dominguez-Péry et al., 2013](#), [Power and Singh, 2007](#)), and changes in the technology, namely by adopting new modules or complementary technologies ([Danese et al., 2006](#), [Dominguez-Péry et al., 2013](#), [Neubert et al., 2011](#)).
- *Technical alignments* involve changes in the network technical setting, including changing business processes (work practices, rules, information sharing means and flows) ([Alin et al., 2013](#), [Dominguez-Péry et al., 2013](#), [Neubert et al., 2011](#), [Power and Singh, 2007](#)) or changing existing systems ([Dominguez-Péry et al., 2013](#), [Power and Singh, 2007](#)), and changes in the technology, including changing functionalities or integrating it with existing systems ([Dominguez-Péry et al., 2013](#), [Neubert et al., 2011](#)).
- *Capacity alignments* involve changes in network capacity, including changing the number of resources available ([Dominguez-Péry et al., 2013](#), [Meyers et al., 2012](#), [Power and Singh, 2007](#)), namely by “hiring” more resources to overcome some lack of capacity (capacity misalignment).

4.1. Introduction

Likewise, misalignments can be classified using the classes structural, technical and capacity, which consist of lacks of compatibility between, respectively, the structure, technical setting, or capacity of the network and those required to use the technology conveniently. Additionally, at the beginning of the implementation, context misalignments between the technology and the local operational context of the network ([Hartmann et al., 2009](#)) may be identified.

For the purpose of our study we define sequences of alignment as the sequences of efforts to align the technology and the network, triggered by, and towards overcoming, misalignments between them. For instance, a structural misalignment that triggers a structural alignment effort is a sequence of alignment according to the previous definition. Similarly, a technical misalignment that triggers a capacity alignment effort, which then results in a new technical misalignment that in turn triggers a technical alignment effort, is also a sequence of alignment, but involving more efforts. Research on sequences of alignments during implementations of technologies in networks has been scarce ([Alin et al., 2013](#)). In fact, several authors have identified sequences of alignment as a promising future research direction to improve the understanding of implementations of technologies in networks ([Croom, 2005](#), [Dominguez-Péry et al., 2013](#), [Hadaya, 2009](#), [Neubert et al., 2011](#)). Among the handful of studies that address that phenomenon, most focus on describing the process of implementation as a sequence of misalignments and alignment efforts ([Alin et al., 2013](#), [Dominguez-Péry et al., 2013](#), [Neubert et al., 2011](#), [Wei et al., 2005](#)). From this perspective, the alignment process is conceptualized as a complex, sequential and evolutionary process that results from interactions between alignments from different classes ([Neubert et al., 2011](#)), suggesting that the implementation progresses as a cascading sequence of alignments, and that there seems to be a non-linear relation between the classes of misalignments and subsequent alignment efforts throughout those sequences.

Cascading and non-linear sequences have also been studied in other fields of research related to innovation processes. Cascading sequences have been identified, for instance, in research on service system innovations. [Eaton et al. \(2015\)](#), while exploring the evolution of boundary resources of service systems enabled by digital technologies, found that those boundary resources “are shaped and reshaped through distributed tuning, which involved cascading actions of accommodations and rejections of a network of heterogeneous actors and artefacts.” In the innovation literature, [Kaafarani and Stevenson \(2011\)](#), based on several observations, formalize the concept of “cascading” as the sequence of one innovation

4. Sequences of alignment between technologies and adopters: Case research of implementations of a new health screening program

inspiring ideas for other innovations in a natural progression. This concept had already been used before by [Vonortas and Spivack \(2006\)](#) who conclude that in large research partnerships some organizational and management procedures comprehend an environment of cascading waves of innovation. In another field, the “systems of innovation approach” ([Edquist, 2005](#)) considers contextual influences (e.g., complementary innovations, cultural aspects of the innovation system, and government interventions) as a cascading set of effects arising from various participants and innovations, that influence the development, diffusion and use of a focal innovation ([Vega et al., 2008](#)). For the purpose of our study we consider a cascading sequence of alignment as a sequence of an alignment effort to overcome a first misalignment, which triggers further misalignments that in turn require further alignment efforts.

Non-linearity has also been found to be an intrinsic characteristic of innovation processes. Non-linearity most often refers to fact that innovation processes are not well-behaved and linear being instead complex, uncertain, and disorderly ([Kline and Rosenberg, 1986](#)). Implementation processes are also highly non-linear, characterized by shocks and setbacks ([Greenhalgh et al., 2004](#)), i.e., moving forward and backwards ([Chreim et al., 2012](#)).

For the purpose of this study, non-linearity refers to interactions between alignments of different classes (structural, technical, or capacity) during the sequence of alignment, i.e., the misalignments and the corresponding alignment efforts being of different classes (e.g., when a technical alignment effort is carried out to overcome a structural misalignment). A similar definition can be found in the innovation literature. The “systems of innovation approach” appears to mix both definitions of non-linearity in its understanding of innovation processes as interdependent and non-linear processes, in which innovations are influenced by the components of the systems and by the non-linear relations between them ([Edquist, 2005](#), [Edquist and Hommen, 1999](#)). Innovation processes have also been recognized to feature interdependencies between product and process innovation, in a non-linear progress including interactions between both that feed each other ([Milling and Stumpfe, 2000](#)), instead of purely straight product or process innovation. Focusing on innovative capabilities, [Schneckenberg et al. \(2015\)](#) argue that the microfoundations of those capabilities reside in organizational and managerial structures, systems, processes, and procedures, with the interdependencies and interactions between those categories fostering knowledge creation and learning processes, and leading to higher performance, once again suggesting non-linear interactions, in this case, between organizational and managerial categories.

4.1. Introduction

Non-linear sequences of alignment are important mechanisms in implementation projects because some dimensions of the network or the technology may be difficult to change, but may be easily influenced by changes in other dimensions ([Gibson et al., 2015](#), [Wakerman and Humphreys, 2011](#)). For example, as will be observed later in the case studies, a capacity misalignment in one organization of the network may be difficult to overcome by a capacity alignment effort, because of difficulties in allocating more resources, but may be overcome by a technical alignment of the business process.

Cascading sequences of alignment also emerge as important mechanisms throughout the implementation process because alignment efforts carried out to overcome a previous misalignment may create new misalignments, which in turn require further alignment efforts ([Wei et al., 2005](#)).

In line with what has been observed for innovation processes, which precede implementation processes because innovation comes before implementation, the study of non-linear and cascading sequences of alignment has the potential to contribute to improve our understanding of implementation management, more specifically of the management of sequences of alignment. Accordingly, the research questions that guide our work are as follows:

- RQ1: How do non-linear and cascading sequences of alignment between a technology and a network of organizations arise during implementation projects?
- RQ2: What are the consequences of non-linear and cascading sequences of alignment in the implementation process?
- RQ3: How are non-linear and cascading sequences of alignment managed during implementations of technologies in networks of organizations?

To address these questions, we conducted inductive multiple case research on the implementations of a health screening program in several networks of healthcare providers located in the North of Portugal.

Section 4.2 presents the method used to conduct the multiple case research and provides a brief description of the case studies. In Section 4.3 the non-linear and cascading sequences of alignments identified in the case research are presented, providing the relevant information for the discussion in Section 4.4. Finally, in Section 4.5 the most important conclusions are

presented, and the contributions for management literature and implementation management practice are highlighted.

4.2 METHOD

To explore the proposed research questions, we conducted an inductive multiple case research of implementations of a diabetic retinopathy screening program in the North of Portugal. This screening program, which since 2009 had been gradually implemented in the North of Portugal by the Regional Health Authority (RHA), was considered an appropriate setting for this study because it is provided by networks of healthcare organizations and uses a set of technologies that support its operations, and also because it is an important procedure that must be performed by all diabetic patients desirably on a yearly basis ([WHO, 2006](#)), which ensures its continuity. In this section the screening program is briefly presented, together with the methods used for data collection and analysis.

4.2.1 DIABETIC RETINOPATHY SCREENING PROGRAM

The number of people with diabetes mellitus is increasing and will keep increasing in the coming years ([WHO, 2006](#)). In Portugal, its prevalence increased 11% between 2009 and 2014, from 11.7% to 13.1% of the total population ([Diabetes, 2015](#)). Diabetic retinopathy is the major cause of avoidable blindness in the population between 20 and 64 years old. It affects about 98% of type I diabetics and 50% of type II diabetics after 20 years of having diabetes, and evolves quietly, with the symptoms appearing only in the late stages of the disease ([Tavares, 2009](#)). For these reasons, the successful implementation of the retinopathy screening program is very important to reduce the incidence of blindness in the population.

In the North of Portugal, the diabetic retinopathy screening program is being implemented by the RHA. It is provided by networks of hospitals and Primary Care Centre groups (PCC groups), each composed of several Primary Care Units (PCU) distributed in the geographical area covered by the PCC group, and is supervised by the RHA.

The screening program is based on a screening process defined by the RHA ([ARSN, 2009](#)) according to the recommendations of the World Health Organization ([WHO, 2006](#)). The screening process begins with the selection of the diabetic patients who meet the criteria to be screened, which is carried out by the PCU general physicians (GPs). Blind or bedridden patients are not included in the screening. According to a screening plan defined by the RHA

4.2. Method

together with the local hospital, the PCU secretaries then schedule screening exams for each selected patient, and send out an invitation letter with the time, date and location of the screening.

The screening exam is performed with a portable retinographer, which requires a completely dark room, and also requires a seat with adjustable height, so that the patient's eyes are levelled with the machine lens. A close waiting room allows the patients to be quickly called for the exam. Orthotic technicians travel from the local hospital to the PCU to perform the exam. They take several pictures of the eyes of each patient, according to the screening process guidelines ([ARSN, 2009](#)). The images are then sent to a reading centre for evaluation by ophthalmologist physicians, via the software that supports the screening program, which we will call ScreenSoft.

There is a single reading centre for all North of Portugal, which processes the exams for all the networks in the region. The reading process produces a report for each patient, with one of three possible results: (a) regular, the patient does not have retinopathy; (b) irregular, the patient has retinopathy and needs treatment; or (c) repetition, the exam has to be repeated because the analysis of the images is inconclusive. In the case of the latter, the PCU secretary reschedules the exam and the process is repeated from that point onwards. In cases (a) and (b), the secretary of the PCU informs the patient about the result.

When treatment is required, case (b), a request is automatically sent to the local hospital and to the RHA, including a classification of the case's priority, related to the urgency of treatment, according to the standard classifications defined in the screening process. An ophthalmology secretary in the local hospital schedules treatment sessions and sends an invitation letter to the patient, and an ophthalmology physician performs the treatment. The patient is excluded from the screening program while being treated, i.e., until discharge. This process is illustrated in Figure 7.1 of Appendix A.

The networks providing the screening are composed by the RHA, a local hospital, the PCC groups served by that hospital, and the reading centre. The technologies being implemented are the screening process, which defines the business processes, their workflow and the methods and materials to be used in the screening program, the portable retinographers to perform the exams, and the ScreenSoft software to support the activities of the different professionals, the information flows between the organizations in the network, and the supervision of the program by the RHA.

4.2.2 RESEARCH DESIGN AND SAMPLING

This work follows an inductive research design, using an embedded multiple case study ([Eisenhardt, 1989](#), [Yin, 2009](#), [Barratt et al., 2011](#)). The research design was embedded because there were multiple levels of analysis ([Eisenhardt, 1989](#)). The primary unit of analysis was the implementation project of the screening program in one network of healthcare providers and the embedded units of analysis were: the network of healthcare providers, the healthcare provider organizations, and the technology being implemented (screening program, retinographers, and ScreenSoft). As case research allows rich, in depth empirical descriptions, and is based on a variety of data sources, it provides a suitable research design for examining and clarifying the type of complex processes that we face in this research ([Yin, 2009](#)) – implementation processes involving a large number of critical actors and factors ([Linton, 2002](#)). Moreover, using diversified case studies and a solid literature support, we were able to gather insightful scientific data to analyse and constructs to extract, as suggested by [Eisenhardt \(1989\)](#).

Eight cases were selected, using a theoretical sampling strategy ([Eisenhardt, 1989](#), [Corbin and Strauss, 2015](#), [Barratt et al., 2011](#)) with representativeness of four dimensions:

- Network structures, including networks in which the reading centre is in the local hospital, contrary to what was planned and has been previously described previously, and others in which it is in the hospital defined for that purpose
- Structures of the screening program, including some networks in which the screening exam is performed at a central location rather than in every PCU as initially planned
- Stages of the implementation process, including some networks that had completed only one round of screening and networks that had already concluded two or three rounds, and thus already had more experience with the screening program
- And implementation contexts, including networks located in mostly urban areas, where the population is geographically concentrated, and others located in mostly rural areas, where the population is spread.

This sampling strategy ensures external validity ([Voss et al., 2002](#), [Yin, 2009](#), [Barratt et al., 2011](#)) and helps guard against observer bias ([Voss et al., 2002](#), [Barratt et al., 2011](#)). The sample was large enough to reach theoretical saturation ([Corbin and Strauss, 2015](#), [Eisenhardt, 1989](#)) and to increase our confidence in the understanding developed concerning

4.2. Method

sequences of alignment. Representativeness of four dimensions across cases improved the generalizability of the inducted theory.

Table 4.1 describes the eight cases, highlighting for each network the number of interviews performed, the dimensions, the number of rounds completed, the date when the screening program started, the number and the distribution of patients served by each network.

Network	Number of interviews	Number of PCC groups	Number of organizations	Number of rounds	First round	Population	Distribution of population
RHA	2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1	4	1	4	3	2009	183 618	urban / concentrated
2	8	2	4	1	2011	351 716	urban / concentrated
3	7	2	5	2	2011	360 410	urban / concentrated
4	6	2	4	2	2011	358 865	urban / concentrated
5	7	3	5	2	2010	305 219	rural / spread
6	3	1	4	2	2012	282 211	rural / spread
7	4	2	5	1	2012	367 662	rural / spread
8	5	1	4	1	2013	166 093	rural / spread

Table 4.1 – Description of cases (the RHA line is not a case, it just records the two managers with the responsibility for all the implementations, who are based in that institution)

4.2.3 DATA COLLECTION

The data collection strategy involved semi-structured interviews as primary sources of data, exchange of emails to clarify questions that remained after the interviews, and collecting archival documents and statistical data concerning the outcomes of the implementation. The triangulation of these multiple sources of evidence provided credibility and strengthened our results ([Corbin and Strauss, 2015](#), [Eisenhardt, 1989](#), [Yin, 2009](#), [Barratt et al., 2011](#)).

We collected data from each case in close time periods ([Easterby-Smith et al., 2012](#), [Eisenhardt, 1989](#), [Yin, 2009](#)), mostly between January and August of 2014, period when almost all the interviews took place. However, the interviews with the two implementation managers took place slightly earlier, in July and October 2013, and the documents concerning the screening program were collected in those dates as well. During the beginning of 2015 a few emails were exchanged with the interviewees to clarify remaining questions, and in the second half of 2015 the implementation managers provided retrospective statistical data concerning the screening.

We conducted 46 retrospective semi-structured interviews in order to obtain different perspectives and cross check responses about factual issues, ensuring construct validity ([Yin, 2009](#)). Besides the two implementation managers, who are the same for the eight networks, in each network we interviewed at least one general physician and one secretary for each PCC group, and at least one orthotic technician and one ophthalmologist physician from the local

4. Sequences of alignment between technologies and adopters: Case research of implementations of a new health screening program

hospital. The only exception was network 6, for which no ophthalmologist physicians were interviewed. However, the network was not excluded from the case research because, after analysing its data, we realized that they were only concerned with topics in which the ophthalmologist physician was not involved (interactions between the PCC group and the reading centre, and orthotic technician capacity). The interviews were based on a protocol organized after familiarization with the screening program and the network operations of each case, which ensured reliability ([Yin, 2009](#)). Interviews were focused on gathering data concerning the screening process and structure, the main difficulties faced during the implementation, the adaptations that had been made in the network and in the screening process, including the supporting technologies (retinographer and ScreenSoft), and final comments concerning the perceptions of the interviewees about the screening program, its implementation, and its future.

This research followed the RHA's guidelines for research governance and ethics. Before each interview the interviewee was asked to sign an informed consent approved by the RHA's ethics committee, which presented details concerning the nature of the project, the terms of the interview, and how data would be treated after the interview. The interviews were recorded and transcribed using appropriate analysis software. Only one interviewee declined to have the interview recorded. In that case the interview was conducted with the participation of two researchers, the collected data were crosschecked and a report was written immediately after the interview, increasing the accuracy of the data collection process. The interviews were transcribed as soon as possible, which ensured constant comparison ([Eisenhardt and Graebner, 2007](#)), and allowed a first analysis of the collected data and the improvement of the subsequent interviews ([Corbin and Strauss, 2015](#), [Barratt et al., 2011](#)). The interviews lasted from 11 minutes to 1 hour and 16 minutes, with an average of 30 minutes and a total of approximately 22 hours and 30 minutes, resulting in 395 pages of text transcribed verbatim ([Yin, 2009](#)).

We also collected archival documentation, including official documents of the screening program (its procedure manual and presentations), annual activity reports of the RHA containing and commenting its results, independent reports mentioning its evolution (such as the annual reports of the national observatory for diabetes), and media news about its implementation and results. We also collected statistical data on the outcomes of the different stages of the program (screening exam, reading and reporting, and treatment) for all the eight

4.2. Method

networks included in the research, and exchanged emails with the interviewees whenever any question remained unanswered after the interviews or emerged during data analysis.

4.2.4 DATA ANALYSIS

We explored data iteratively, going back and forth between the qualitative data and theoretical arguments ([Corbin and Strauss, 2015](#)). The analysis was divided in two stages: (1) within case analysis, selecting and organizing the relevant data and searching for within case patterns, and (2) cross-case analysis, searching for cross-case patterns ([Eisenhardt, 1989](#), [Barratt et al., 2011](#)).

We started the within case analysis with a fine-grained reading of the data ([Corbin and Strauss, 2015](#)). We performed a descriptive and simultaneous coding, using appropriate qualitative analysis software (NVivo), in which sets of text were coded with topics that summarize their contents and parts of text that suggested multiple meanings were coded with two or more topics simultaneously ([Miles et al., 2014](#), [Saldana, 2012](#)). A second coding cycle was also completed using pattern coding to lay the groundwork for cross-case analysis by developing common themes, based on the topics of the questions used in the semi-structured interviews ([Miles et al., 2014](#)). For each case study, as a result of within case pattern matching, the screening process of that network was mapped and the collected data were grouped in the following themes: needs and difficulties (misalignments and their consequences), alignment efforts, management interventions concerning or emerging from the implementation, implementation outcomes (routinization, incorporation, and performance of the screening), and perceptions about the screening and its implementation. A report bringing together and organizing the collected data was written and reviewed by peer researchers and by key informants, once more ensuring construct validity ([Yin, 2009](#)).

After being validated, the data from each report were compiled in role-ordered matrices and in a partially ordered meta-matrix ([Miles et al., 2014](#)), assembling descriptive data from each of the cases in standard formats to facilitate the cross-case analysis. Those matrices served as a database for the cross case analysis and ensured reliability of data collection by helping to minimize observer biases ([Easterby-Smith et al., 2012](#), [Yin, 2009](#)). Role-ordered matrices associated the descriptive codes to each interview, allowing for pattern identification among the roles of the interviewees of the different networks. The partially ordered meta-matrix associated summaries of the data from each network to each descriptive code, organizing the

4. Sequences of alignment between technologies and adopters: Case research of implementations of a new health screening program

data to simplify the cross-case pattern matching. These matrices then allowed us to build causal chains that represented the several sequences of alignments observed in each network ([Miles et al., 2014](#)).

Data were then analysed using pattern matching within and among the matrices and among the causal chains, and findings were compared with the existing literature on technology management, namely concerning implementations of technologies, and network theory, namely concerning network governance, which ensured internal validity ([Yin, 2009](#)). A cross-case synthesis was carried out at the end of this process ([Easterby-Smith et al., 2012](#), [Eisenhardt, 1989](#), [Yin, 2009](#)), which allowed us to identify the sequences of alignment in the study, and relate the dynamics of alignment between the network and the screening program, with implementation management interventions, implementation process, and implementation outcome ([Easterby-Smith et al., 2012](#), [Eisenhardt, 1989](#)). From that synthesis, which is presented in Section 4.3, we developed the propositions and recommendations presented in the discussion and conclusion sections.

4.3 FINDINGS

In this section we initially present the sequences of alignment found in each case study, or network, that are relevant to the study of the non-linearity and cascading phenomena. Then we summarize the identified non-linear and cascading sequences of alignment, grouping them in similar sequences, according to the types of misalignments and alignments that they involve, to facilitate the subsequent analysis. Because most of the times a sequence of alignment includes both non-linear and cascading sequences, they are presented together and not separately. In the presentation of the data from each case study (within case analysis) we provide references to the respective non-linear and cascading sequences of alignment, presented in Section 4.3.2 (cross-case analysis).

4.3.1 WITHIN CASE ANALYSIS

4.3.1.1 NETWORK 1

In network 1 the difficulty in maintaining the screening rotating between different PCUs, i.e., the difficulty created by the allocation of work among the organizations in the network (structural misalignment), led to a reallocation, and also to the centralization of the screening

4.3. Findings

in one single PCU (structural alignment), which had appropriate conditions to accommodate the screening (for instance, an appropriate dark room).

However, this centralization caused some patients to experience difficulties in traveling to the PCU, a new structural misalignment (cascading sequence I), due to the absence of transportation services or to difficult traveling plans. Such difficulties are considered structural misalignments because they originate in the structural organization of the network, i.e., the allocation of work among the organizations in the network. This latter structural misalignment had not been overcome by the end of our fieldwork.

Furthermore, when the screening was centralized in one PCU, the responsibility for the scheduling, which used to rotate among the secretaries of the PCUs where the screening was carried out, was also centralized (structural alignment). This allowed the formalization and standardization of scheduling rules (non-linear sequence 2.1 and cascading sequence A), which previously depended on the secretary (technical alignment). Some scheduling rules that were previously possible, such as rescheduling patients who failed an appointment, became unfeasible due to workload constraints. In the case of rescheduling, the secretary decided that the patients had to call in advance to cancel the appointment and reschedule a new one, otherwise they would fail their opportunity to be screened in that round. In addition, a careful analysis of patients' behaviour and complaints, which also became possible due to centralization, led to the definition of new rules. For instance, appointments started to be organized by phone number to guarantee that couples were scheduled together, an arrangement favoured by most of them.

The reading and reporting for the screenings performed in this network were carried out in the reading centre located in network 2. The insufficient level of resources in that reading centre (capacity misalignment) hindered the timely communication of results (leading to a delay of close to one year) and its continuity (leading to peaks), which created difficulties to the management of the ophthalmology professionals' workload in the local hospital of network 1, and resulted in delays in the beginning of the treatments. For this reason, the ophthalmologist physicians changed their *modus operandi* at the end of the treatment sessions for more severe patients (who might require further treatment). They stopped discharging those patients, keeping them in routine appointments inside the hospital, instead of sending them back to the screening program as defined by the screening process (technical alignment of work practices). This way, ophthalmology physicians could avoid that those

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

patients took too long to come back to treatment if needed and risk becoming untreatable. This is one case of non-linear sequence 5.1.

The local hospital of this network experienced difficulties in starting the treatments on time, which created a very long list of patients for treatment. Treatments stopped for over a year due to internal policy reasons, with the cumulative number of patients that started treatment remaining at 165 between 2011 and 2012, as can be observed in Table 4.2. When they restarted, besides the massive delay, there was a lack of treatment capacity to respond in time to the long waiting list (capacity misalignment), a situation that would persist for a long time without a temporary alignment effort. To reduce the long waiting list faster, hospital managers decided to create a new work task for the ophthalmology service secretaries, consisting of checking whether each patient in the list was already being treated in the hospital or not (technical alignment), since some of them had previously been sent to the hospital for other reasons, the retinopathy had been detected and they had started treatment. Hospital secretaries then started to filter the patients before scheduling them: patients already being treated were not scheduled and were excluded from the waiting list. This technical alignment created a new capacity misalignment: the secretaries were not enough to perform the task on time while still performing all their other duties. For this reason, an extra team of secretaries was assigned to help perform the crosschecking, which increased local capacity (capacity alignment) and solved the capacity misalignment. The new work task was kept even after the elimination of the waiting list, because it improved the performance of the treatment scheduling process. This sequence of alignments includes non-linear sequence 5.1 and cascading sequence D.

Network	% called for treatment		% initiated treatment		Cumulative number of initiated treatments		
	2012	2015	2012	2015	2011	2012	2015
1	49.3%	99.4%	99.4%	100%	165	165	687
2	61.4%	99.7%	61.9%	99.5%	95	112	770
3	33.7%	98.1%	81.8%	100%	52	54	576
4	66.7%	98.8%	86.8%	88.5%		270	1 110
5	51%	51.4%	98.1%	98.6%	49	105	145
6	0%	79.7%	0%	72.7%		0	710
7	44.7%	40.3%	100%	99.5%		21	218
8		96.8%		100%			340

Table 4.2 – Patients sent to treatment per network (including the patients called for treatment as a percentage of the patients that needed treatment, the patients that initiated treatment as a percentage of the patients called for treatment, and the cumulative number of patients that initiated treatment)

Finally, some patients of this network did not have adequate transportation services to travel to the local hospital (structural misalignment), particularly because of very limited traveling

4.3. Findings

timetables. Because this structural misalignment was caused by local context conditions (the definition of the population served by the hospital is outside the scope of the screening program), its solution could not be a structural alignment. Consequently, to reduce the misalignment's impact, the local hospital adapted its business process rules, actually once again its scheduling rules, and work practices (technical alignments). In order to reduce the number of visits to the hospital, treatment sessions were grouped in the same appointment as much as possible (for instance, the first exam was also scheduled with the first appointment, instead of at a later time). Similarly, to reduce travel inconvenience, all treatment sessions (typically long sessions) were scheduled according to the patient's availability, i.e., the scheduling was negotiated with each patient (new work practice). This is one of the cases of non-linear sequence 4.

4.3.1.2 NETWORK 2

In network 2, the first round of the screening took longer than planned because PCC group 2-a was merged with another PCC group that was not previously part of the network. The existing technicians were not able to accommodate the increase in number of patients (capacity misalignment due to a change in the context of implementation), and the insufficient capacity resulted in delays, and the inability to meet the time targets of the screening program. As the second round of the screening was taking too long to start, the managers of the other PCC group (2-b) recommended to their GPs the referral of patients to a general ophthalmology appointment in the hospital with a retinopathy screening request, which used to be the practice prior to the implementation of the new screening program. This technical alignment had a negative impact on the routinization of the screening in PCC group 2-b. The number of patients called for the screening decreased significantly from the first to the second round (from 8 686 to 5 790), as can be observed in Table 4.3. This is one of the cases of non-linear sequence 5.1.

4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program

Network- PCC group	Rounds (finished until 2013)	First round (beginning)	2010			2011			2012			2013		
			Patients called	Affluence		Patients called	Affluence		Patients called	Affluence		Patients called	Affluence	
1-a	2	2009				7 986	5 835 – 73.1%					10 201	5 347 – 52.4%	
2-a	1	2011							11 651	5 591 – 48.0%				
2-b	2	2011				8 686	4 814 – 55.4%					5 790	2 460 – 42.5%	
3-a	2	2011				8 924	4 240 – 47.5%					9 973	3 570 – 35.8%	
3-b	2	2011							8 796	4 421 – 50.3%				
4-a	1	2012										9 602	4 842 – 50.4%	
4-b	2	2011							7 754	4 451 – 57.4%		12 884	8 065 – 62.6%	
5-a	3	2010	3 673	2 908 – 79.2%					5 016	3 155 – 62.9%		2 851	1 908 – 66.9%	
5-b	1	2011							6 108	3 191 – 52.2%				
5-c	1	2011				6 165	3 281 – 53.2%							
6-a	1	2012										16 206	11 279 – 69.6%	
7-a	1	2012										9 998	5 994 – 60.0%	
7-b	1	2012										7 908	4 716 – 59.6%	
8-a	1	2013										9 423	5 603 – 59.5%	

Table 4.3 – Participation in the screening per network and PCC group (including the number of rounds completed, the date of the beginning of the first round of screening, the total number of patients called per round, and the number and percentage of participants per round)

4.3. Findings

The reading centre, located in this network, faced difficulties to meet the reading time targets established by the screening process, due to lack of resources. To solve that capacity misalignment, more ophthalmology physicians were assigned to the reading of the exams (capacity alignment) and ScreenSoft was changed to allow those physicians to perform the readings remotely, using a virtual private network connection (technical alignment). This technical alignment of ScreenSoft allowed the professionals to allocate more of their time to the readings, in particular when they were not at the hospital. This is one of the cases of non-linear sequence 5.2.

That capacity misalignment could also be partially overcome, at least for the patients with a more immediate need for treatment, if the technicians could share with the reader their perceptions about the urgency of treatment. This information would allow a prioritization of the readings, i.e., allow the readers to process first the exams of the most urgent patients to ensure that when treatment was needed they would be quickly referred to the local hospital. This was initially a technical misalignment, because the technicians did not have that possibility (a work practice and ScreenSoft functionality misalignment), and was uncovered by the capacity misalignment of the reading centre (non-linear sequence 6 and cascading sequence G). The technical misalignment was observed in networks 1, 2, 3, 6, and 7 (Table 4.5), i.e., all the networks in which the reading centre provided the reading service but one (network 8, in which the collected data were scarcer).

The technical misalignment was overcome in 2013 with the introduction of a new functionality in ScreenSoft, which allowed technicians to associate information about the perceived urgency of treatment to the exam. This technical alignment reduced the impact of reading delays, because most patients with an urgent need for treatment started to be sent to the local hospital on time. This technical alignment effort was implemented in networks 1 and 2 even before the functionality was available on ScreenSoft, through improvised efforts to send the information (perceived urgency of treatment) to the readers, using a formal communication channel in network 1 and an informal (direct) one in network 2, both new work practices (improvised technical alignments). In network 1, the technicians would communicate the urgent cases to the PCC group director, who would then communicate them to the implementation manager at the RHA, who in turn would send them to the ophthalmologist physicians who read the exams. In network 2 the technicians communicated the urgent cases directly to the ophthalmologist physicians who read the exams, because they shared the same network and hospital. These improvised technical alignments were actually

4. Sequences of alignment between technologies and adopters: Case research of implementations of a new health screening program

what drew the attention of professionals and managers, implementation managers in particular, to the new technical misalignment and to its final solution (the new functionality for ScreenSoft).

The latter technical alignment, together with the previous capacity and technical alignments concerning the number of readers and the possibility of reading remotely, had a positive impact on the efficiency of the process (part of the implementation outcome), making the delays almost insignificant, as can be observed in Table 4.4, between 2012 and 2013.

Year	Number of retinographies	Number of reported retinographies	% reported
2010	7 766	4 508	58.05%
2011	34 860	22 823	65.47%
2012	47 704	32 198	67.50%
2013	54 999	51 688	93.98%

Table 4.4 – Total readings per year in the North of Portugal (including the total number of retinographies performed, and the number and percentage of retinographies read, i.e.

retinographies with a report)

The lack of reading capacity could also be partially addressed if some of the readings were performed automatically with appropriate software (the complementary technology). Such software could produce the reports for the most obvious cases (clear need for treatment or no treatment) and the readers (ophthalmology physicians) would process the remaining cases. Although this software would still have to be monitored frequently by the readers, to check its performance (double checking randomly selected reports), implementation managers believe it would significantly reduce the readers' workload. This would be a structural alignment of the screening program (non-linear sequence 5.3), the inclusion of a new system that would perform part of the readers' work, lowering their workload and solving (at least partially) the capacity misalignment. However, this structural alignment had not yet been implemented by the end of our fieldwork, essentially because the implementation managers had not yet found any software capable of performing this task with (the quality of) the images provided by the screening machines.

4.3.1.3 NETWORK 3

In network 3, in PCC group 3-a the screening was centralized in one PCU (structural alignment), for the same reason as in network 1, i.e., mainly due to difficulties with space and machine transportation between PCUs (structural misalignment). However, the location chosen to perform the screening was the head PCU of the PCC group, which was located in one extreme of the PCC group. This created transportation difficulties for the patients that

4.3. Findings

lived in the other end, i.e., a new structural misalignment emerged from the centralization of the screening. When the local managers realized those new difficulties, the screening was moved to a PCU located at the centre of the PCC group, which also had a room with the appropriate conditions to receive the screening (structural alignment). However, the nearest public transport stops were distant from the PCU and the path had a steep hill, which created additional difficulties for elderly patients (structural misalignment), not yet resolved at the end of our fieldwork. This sequence of alignment illustrates cascading sequence J.

4.3.1.4 NETWORK 4

As previously mentioned, the screening exam was planned to be carried out in the PCUs of each network and read in a regional reading centre, located in the hospital of network 2. However, the hospital of network 4 already had its own local screening program implemented, a fact that was not expected and was not the case in the other networks (context misalignment, non-linear sequence 1). The hospital managers were interested in keeping the local screening program running, in particular because of their commitments with the institutions that were financing their screening equipment (fixed machines that could not be transported to the PCUs, unlike the machines bought by the RHA). This context triggered negotiations between the hospital managers of network 4 and the implementation managers, leading to an agreement containing structural and technical alignment efforts before starting the implementation. The screening was centralized in the local hospital, which performed the screenings, readings and treatments. This alignment required alignment efforts not only in the new screening program, but also in the network, because the previous local screening was entirely performed in the hospital and in the new screening program some activities had to be transferred to the PCUs, particularly the activities of selecting the patients for screening, and scheduling.

Furthermore, a technical alignment was also required: ScreenSoft had to be integrated with the software that the local hospital was using in the ophthalmology service, which we will call OphthalSoft. Because OphthalSoft was more complete than ScreenSoft, the former was preserved and integrated with the latter, so that the PCUs could use the latter. In this network ScreenSoft was being used to support only the activities of the PCUs and information sharing among the organizations in the network, in particular with the local hospital and with the RHA.

4. Sequences of alignment between technologies and adopters: Case research of implementations of a new health screening program

In this network, the orthotic technicians decided to accept extra patients. However, unlike other networks where the extra patients were received *ad hoc*, because the technicians were dedicated only to that task, in this network the screening was performed in the local hospital, and the technicians had to integrate it in their daily plan. Accordingly, it was decided that the extra screenings had to be scheduled by the PCU secretary in two time slots available per day. A new scheduling rule (technical alignment) was thus created, in order to adequately integrate the workload of the screening program with their remaining work at the hospital, and make sure that all the planned screenings (including the two extra daily appointments) could be performed. This is one of the cases of non-linear sequence 2.1 and cascading sequence A.

However, when ScreenSoft was adapted to allow the scheduling of extra slots, the possibility of setting a limit to their number was not included (technical misalignment). As a consequence, the secretaries of the PCUs sometimes scheduled more than two extra patients for the same day, exceeding the available technician capacity (creating a capacity misalignment) and contributing to a global delay of the screening. The technicians then requested the inclusion of the limit (technical alignment), and the problem was resolved. This sequence of alignment includes non-linear sequence 5.2 and cascading sequence E.

As another consequence of the centralization of the screening in the local hospital, a more complete exam could be implemented, including health conditions that were not included in the screening program's plan. This technical alignment was created to take advantage of the better technical conditions offered by the local hospital to perform the exam (more, and more qualified, staff, appropriate rooms, and better machines) when compared to the conditions offered by the PCUs (non-linear sequence 2.2 and cascading sequence A).

4.3.1.5 NETWORK 5

In network 5 a new ophthalmology centre was inaugurated just before the beginning of the implementation of the new screening program. That centre was able to allocate a high level of capacity to the execution of the screening program, because initially it had few routine patients, and its professionals were also interested in using the new local screening machines (fixe as in network 4). This context also triggered negotiations between the hospital managers of network 5 and the implementation managers, leading to an agreement on structural and technical alignment efforts before starting the implementation. This is another case of non-linear sequence 1.

4.3. Findings

Once again, similarly to what happened in network 4, it was agreed that in this network the screening would be centralized in the new ophthalmology centre (structural alignment). And as a consequence of the centralization of the screening in the local hospital, a more complete exam could be implemented, to take advantage of the better technical conditions offered by the local hospital to perform the exam, when compared to the conditions offered by the PCUs (non-linear sequence 2.2 and cascading sequence A).

However, because this is the largest network in terms of geographical distribution of patients, and the ophthalmology centre is located in one extreme of the network, several patients had difficulties in traveling to the ophthalmology centre (the screening site), because of the need to change means of transportation multiple times, or because of age-related mobility difficulties. To solve that structural misalignment, in some PCC groups, after discussions with the other members of the network (RHA and local hospital), local managers approached the municipalities to seek transportation from the PCUs to the ophthalmology centre for their patients. Some of the municipalities agreed and were therefore included in the network (structural alignment effort of adding a new member to the network), together with a new service (structural alignment effort of adding a new business process).

This structural alignment created a misalignment of knowledge basis (technical misalignment), because transportation information (place and time of departure) was not included in the letter inviting the patients for the screening. This required the creation of a new template to include that information, which was promptly made available by the providers of ScreenSoft, a technical alignment of ScreenSoft (non-linear sequence 2.3 and cascading sequence B).

Some of the municipalities had limitations concerning the number of patients that they could transport, or the time period in which the vehicle could be available during the day, because the same vehicle would be used to provide other transportation services, such as transportation of children for school (capacity misalignment).

This lack of transportation capacity triggered the alignment of the screening scheduling plan (time window and number of daily scheduling slots) to account for vehicle availability. Before defining the scheduling plan, the network managers (of the PCC groups and the ophthalmology centre) needed to know the availabilities of the vehicles, something that was not planned in the screening process (a technical misalignment of information sharing caused by the capacity misalignment). Subsequently, in each round of the screening, the RHA started

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

to inform the PCC group sooner than usual about the dates of the screening round, in order for the PCC group managers to have time to negotiate the screening scheduling slots with the municipalities and the ophthalmology centre – this negotiation was also a new work practice (technical alignment), that was not part of the initial process (the scheduling slots were defined by the RHA). During the negotiations the scheduling slots would be defined (capacity alignment efforts embedded in the new work practices), and later communicated to the software provider to be included in ScreenSoft (this latter step already considered in the initial plan). This sequence of alignment includes non-linear sequence 3 and cascading sequence C.

In this network, over time, the ophthalmology centre started to have more patients to follow and the availability for the screening was reduced (capacity misalignment). Furthermore, the number of professionals started to decrease, especially because most of the professionals had been displaced from their hometowns and the working conditions that were offered in the centre were not attractive. As a consequence of this capacity misalignment, some GPs began to refer their patients to ophthalmology appointments to perform the screening, similarly to what happened in network 2 (non-linear sequence 5.1). To reduce delays, the ophthalmology physicians also decided to stop accepting requests for rescheduling (technical alignment). The elimination of duplicate appointments freed up screening appointments later in the rounds, which became shorter, requiring less capacity (solving the capacity misalignment).

However, this adaptation had the drawback of not making sure that every patient was screened, which may explain the decline in participation observed in PCC group 5-a from the second to the third screening round (Table 4.3). As a consequence, some Key Performance Indicators (KPIs) related to the screening program (the number of patients screened in each round and the duration of each screening round) had to be removed from the contract between the RHA and the PCC groups (technical alignment), because PCC groups were being misevaluated as a result of local hospital decisions. This latter technical alignment did not help to solve or reduce the capacity misalignment, but it solved the unfair situation caused by that misalignment and the subsequent change of scheduling rules implemented by the ophthalmology centre (non-linear sequence 5.4 and cascading sequence F). However, removing those KPIs also removed their contribution as a mechanism for motivation of the GPs to participate in the screening program, hurting the routinization of the screening. This may explain the decrease in the number of patients selected for screening from the second to

4.3. Findings

the third round in PCC group 5-a, as a reflection of a reduced participation from GPs (Table 4.3).

Also as a consequence of the capacity reduction in the ophthalmology centre, a structural alignment carried out in the first round of the screening had to be cancelled (non-linear sequence 7 and cascading sequence H). In the PCC group farthest from the ophthalmology centre (PCC group 5-b), where patients had more transportation difficulties (structural misalignment), the second round of the screening was performed in a local PCU, with a portable machine that the RHA made available. This alignment effort increased patient participation. However, as the capacity of the ophthalmology centre decreased (capacity misalignment), the local hospital had to stop providing this service and the screening was centralized in the ophthalmology centre for all the PCC groups again.

4.3.1.6 NETWORK 6

In network 6, once the professionals realized the lack of capacity from the reading centre to perform the readings on time (capacity misalignment), they decided to reduce the number of screenings performed per day (technical alignment). This effort of alignment in the scheduling rules was found to have a low impact on the screening times (targets) and reduced the amount of work sent to the reading centre, and thus also the required reading capacity (non-linear sequence 5.4).

4.3.1.7 NETWORK 7

In network 7 the screening was performed by three technicians who divided the work among them. They performed the screening only twice a week, one hour and a half in the morning and one hour and a half in the afternoon. The remainder of their working day time was dedicated to their duties at the local hospital. The traveling time would be included in the time available for the screening, which meant that less time would be available to perform the screening for more distant PCUs (structural misalignment, the penalizing nature of part of the network, leading). For that reason, technicians proceeded to change some work practice rules, in order to stop accepting patients that went to the PCU in a day other than that of their appointment. With this technical alignment, the technicians became capable of performing all the screenings planned for each day, and avoided duplicate appointments (patients scheduled for one day who had already performed the screening or who would perform the screening in a following day) (non-linear sequence 4).

4. Sequences of alignment between technologies and adopters: Case research of implementations of a new health screening program

In this network, the screening was performed in all PCUs, as initially planned. However, as patients are widely dispersed, some of them still had difficulties in traveling to the PCU (structural misalignment). One solution devised by local managers to overcome this misalignment was to have the screening performed in every town hall (structural alignment). However, that solution was never implemented, and actually the idea was dropped quickly, because the internet access required for the equipment that supported the screening would be impossible to set up in those organizations, i.e., a technical misalignment prevented the structural alignment (cascading sequence K).

4.3.1.8 NETWORK 8

In network 8 the screening was performed in two central PCUs, because of bad transportation conditions for the machine, as in network 1. However, in this network the population was very spread and several patients had difficulties traveling to the locations of the screening (structural misalignment). After observing the behaviour of some of those patients, the PCC group managers decided to change the organization of the scheduling and start grouping patients from the same village (technical alignment), i.e., schedule those patients in consecutive screening slots (non-linear sequence 2.1 and cascading sequence A). This allowed the patients to start sharing transportation, which was expected to increase the participation in the screening. With this solution, the local managers were also able to avoid going back to the network structure planned for the screening, in which the screening would be performed in all the PCUs, which would lead to a reappearance of the first structural misalignment (difficulty moving the machine).

4.3.2 CROSS-CASE ANALYSIS

The previous findings, from the within case analysis, provide detailed evidence about non-linear and cascading sequences of alignment during implementation projects in networks of organizations. Seven different non-linear sequences have been identified, and are described in the following paragraphs and summarized in Table 4.5. The identified cascading sequences are introduced in Table 4.6 and are also presented in the following paragraphs.

Because they usually refer to a same sequence of alignment, cascading sequences (named alphabetically) were sorted to match the order of the non-linear sequences (named numerically). In the notation used to represent the sequences of alignment, ‘>’ denotes the triggering of the misalignment or alignment effort on the right by the one on the left, and ‘<’

4.3. Findings

a cancellation or unfeasibility of the alignment on the left due to the misalignment on the right.

Non-linear sequence	Networks	Initial misalignment or alignment effort	Triggered misalignment or alignment effort	Cause for initial misalignment or alignment effort
1) Context misalignment > structural and technical alignments	4	Misalignment between screening program and implementation context	Structural alignment - Change network structure; Technical alignment - Integrate supporting software with existing systems	Existence of previous screening program
	5		Structural alignment - Change network structure	New ophthalmology centre
2) Structural alignment > technical alignment	1	Change of network structure	Variation 2.1) Change of scheduling rules	Difficulty moving the machine between PCUs
	4			Existence of previous screening program
	8			Difficulty moving the machine between PCUs; Traveling difficulties for patients
	4		Variation 2.2) Change of business processes / capabilities	Centralization in hospital - better resources
	5			Traveling difficulties for patients going to ophthalmology centre (screening location)
	5		Variation 2.3) Adapt supporting software	Traveling difficulties for patients going to ophthalmology centre (screening location)
3) Structural alignment > capacity and technical alignments	5	Change of network structure	Technical alignment - Adapt business process; Capacity alignment - Adapt resources available	Traveling difficulties for patients going to ophthalmology centre (screening location)
4) Structural misalignment > technical alignment	1	Unfavourable nature of network	Change of scheduling rules and work practices	Traveling difficulties for patients going to hospital (screening location)
	7			Traveling difficulties for technicians going to PCUs (screening location)
5) Capacity misalignment > technical alignment	1	Lack of reading capacity	Variation 5.1) Change of work practices	Lack of resources
	2	Lack of screening capacity		Merger of PCC groups - increased need for screening capacity
	5	Lack of screening, reading, and treating capacity		Increased workload and reduced staff in ophthalmology centre (screening location)
	2	Lack of reading capacity	Variation 5.2) Adapt supporting software - functionality	Lack of resources
	4	Lack of screening capacity		No limitation for extra screenings scheduled in the PCUs (technical misalignment)
	All	Lack of reading capacity	Variation 5.3) Adopt complementary system	Lack of resources
	5	Lack of screening capacity	Variation 5.4) Change of scheduling rules and evaluation rules	Increased workload and reduced staff in ophthalmology centre (screening location)
	6	Lack of reading capacity		Lack of resources
6) Capacity misalignment > technical misalignment	1	Lack of reading capacity	Lack of functionality > technical alignment (adapt supporting software - add new functionality)	Lack of resources
	2			
	3			
	6			
7) Capacity misalignment > structural alignment	5	Lack of screening, reading, and treating capacity	Change of network structure	Increased workload and reduced staff in ophthalmology centre (screening location)
	7			

Table 4.5 – Summary of non-linear sequences observed in the multiple case research

4. Sequences of alignment between technologies and adopters: Case research of implementations of a new health screening program

Identifier	Cascading sequence	Networks
A	<i>A.1) Structural misalignment > structural alignment > technical alignment</i>	1
	Difficulty maintaining the screening rotating > Centralization of the screening (work reallocation) > Change scheduling rules (change business process rules)	
	<i>A.2) Context misalignment > structural alignment > technical alignment</i>	4 and 5
	Existence of a local screening program or Existence of a new ophthalmology centre > Centralization of the screening (work reallocation) > Change scheduling rules (change business process rules) or Perform a more complete exam (change work practice)	
	<i>A.3) Structural misalignment > structural alignment > structural misalignment > technical alignment</i>	8
	Difficulty maintaining the screening rotating > Centralization of the screening (work reallocation) > Difficulty of some patients to travel to the screening site > Change scheduling rules (change business process rules)	
B	<i>Context misalignment > structural alignment > structural misalignment > structural alignment > technical misalignment > technical alignment</i>	5
	Existence of a new ophthalmology centre > Centralization of the screening (work reallocation) > Difficulty of some patients to travel to the screening site > Include new member with transportation service > Lack of information about transport service in the invitation letter > Creation of a new template for the invitation letter (creation of new functionality)	
C	<i>Context misalignment > structural alignment > structural misalignment > structural alignment > capacity misalignment > technical misalignment > technical alignment > capacity alignment</i>	5
	Existence of a new ophthalmology centre > Centralization of the screening (work reallocation) > Difficulty of some patients to travel to the screening site > Include new member with transportation service > Limitation of transportation capacity > Need to share information about availability of transport > Negotiate scheduling slot (create new work practice) > Define scheduling slots (align capacities)	
D	<i>Capacity misalignment > technical alignment > capacity misalignment > capacity alignment</i>	1
	Lack of treatment capacity > Create new work task (check if patients are being treated before scheduling them) > Lack of capacity to perform new task > Assign extra team to perform new task	
E	<i>Context misalignment > structural alignment > technical alignment > technical misalignment > capacity misalignment > technical alignment</i>	4
	Existence of a local screening program > Centralization of the screening (work reallocation) > Change scheduling rules (accept extra patients – change business process rules) > Lack of functionality to limit number of extra patients > Lack of technicians to screen all extra patients > Create new functionality	
F	<i>Capacity misalignment > technical alignment > technical misalignment > technical alignment</i>	5
	Lack of capacity of the ophthalmology centre > Do not accept reschedules (change business process rules) > Penalize KPIs of PCC groups > Remove those KPIs (change existing systems)	
G	<i>G.1) Capacity misalignment > technical misalignment > technical alignment</i>	3, 6, and 7
	Lack of reading capacity > Lack of possibility to share technicians' perspectives about urgency of treatment (lack of functionality) > Create new functionality	
	<i>G.2) Capacity misalignment > technical misalignment > improvised technical alignment > technical alignment</i>	1 and 2
	Lack of reading capacity > Lack of possibility to share technicians' perspectives about urgency of treatment (lack of functionality) > Improve communication channel between technicians and readers (creation of new information sharing flow) > Create new functionality	
H	<i>Context misalignment > structural alignment > structural misalignment > structural alignment < capacity misalignment > structural misalignment</i>	5
	Existence of a new ophthalmology centre > Centralization of the screening (work reallocation) > Difficulty of some patients to travel to the screening site > Decentralize screening for farthest PCC group (work reallocation) < Lack of capacity of the ophthalmology centre > Centralization of the screening (work reallocation)	
I	<i>Structural misalignment > structural alignment > structural misalignment</i>	1
	Difficulty maintaining the screening rotating > Centralization of the screening (work reallocation) > Difficulty of some patients to travel to the screening site	
J	<i>Structural misalignment > structural alignment > structural misalignment > structural alignment > structural misalignment</i>	3
	Difficulty maintaining the screening rotating > Centralization of the screening (work reallocation) > Difficulty of some patients to travel to the screening site > Centralization of the screening in a more central PCU (work reallocation) > Difficulty of elderly patients to travel to the screening site	
K	<i>Structural misalignment > structural alignment < technical misalignment</i>	7
	Difficulty of some patients to travel to the screening site > Centralization of the screening in every town hall (work reallocation) < Lack of appropriate internet connections	

Table 4.6 – Schematic representations of the cascading sequences

NON-LINEAR SEQUENCE 1: CONTEXT MISALIGNMENT TRIGGERS STRUCTURAL AND TECHNICAL ALIGNMENTS

This first non-linear sequence starts with a misalignment between the implementation plan and the local context in which the network operates (context misalignment). It triggered two alignment efforts in network 4, one structural and one technical, and a structural alignment

4.3. Findings

effort in network 5 (Table 4.5). The structural alignments consisted of reallocations of work among the organizations, and in the technical alignment the software that supports the screening program was integrated with software that already existed in the network. In the structural alignments, one of the modules of the technology – the screening exam – was relocated to another organization – it was planned for the PCUs, but was moved to the local hospital.

NON-LINEAR SEQUENCE 2: STRUCTURAL ALIGNMENT TRIGGERS TECHNICAL ALIGNMENT

This second non-linear sequence was observed in several networks, and featured an initial structural misalignment between the network and the screening process, addressed with structural alignment efforts, which in turn triggered technical alignments. Three variations of the technical alignment efforts were identified: change of rules, inclusion of new work tasks, and adaptation of the modules of the screening program that allowed information sharing.

NON-LINEAR SEQUENCE 2.1: STRUCTURAL ALIGNMENT TRIGGERS TECHNICAL ALIGNMENT OF RULES

This variation of non-linear sequence 2 was observed in networks 1, 4, and 8 (Table 4.5). In networks 1 and 8, the screening exam had to be centralized (structural alignment) due to difficulties in maintaining the screening machine moving around the PCUs, whereas in network 4 the centralization was caused by the existence of a previous screening program. In networks 1 and 4 the centralization of the screening provided the opportunity to change the scheduling rules (technical alignment) in order to improve the efficiency of the scheduling process, while in network 8 a similar technical alignment was instead a solution for a new structural misalignment created by centralization – the difficulties of patients in traveling to the new screening location.

NON-LINEAR SEQUENCE 2.2: STRUCTURAL ALIGNMENT TRIGGERS TECHNICAL ALIGNMENT OF BUSINESS PROCESS (INCLUSION OF NEW WORK TASK / CAPABILITY)

This variation of non-linear sequence 2 was observed in networks 4 and 5 (Table 4.5). In these networks the screening exam was centralized in the local hospital. Both hospitals offered better resources than the PCUs, enabling a more complete exam, in a technical alignment that added new capabilities to the screening program.

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

CASCADING SEQUENCE A

The three instances of non-linear sequence 2.1 and the two instances of non-linear sequence 2.2 illustrate the cascading nature of sequences of alignment (Table 4.6): structural alignment efforts to solve an initial misalignment (of context or structure) either created the conditions for new alignment efforts that took advantage of the available resources to improve the performance of the implementation, or created new misalignments that required further alignment efforts.

NON-LINEAR SEQUENCE 2.3: STRUCTURAL ALIGNMENT TRIGGERS TECHNICAL ALIGNMENT
OF MEANS OF INFORMATION SHARING

This variation of non-linear sequence 2 was observed in network 5 (Table 4.5). The structural alignment consisted of the inclusion of a new member in the network to bring a new service (business process), and created a new technical misalignment related to the template of the letter that was used to invite the patients for the screening. To solve this new misalignment, a simple technical alignment was defined – the adaptation of the letter template, i.e., of a means of information sharing between the screening provider and the patients.

CASCADING SEQUENCE B

This cascading sequence of alignments also resulted from the inclusion of new members in network 5. It starts with the centralization of the screening in the ophthalmology centre, which creates traveling difficulties for patients (structural misalignment) and triggers the inclusion of a new member in the network (structural alignment), the municipalities. The service that the municipalities bring to the network creates the technical misalignment mentioned above and triggers the respective alignment effort.

NON-LINEAR SEQUENCE 3: STRUCTURAL ALIGNMENT TRIGGERS CAPACITY AND TECHNICAL
ALIGNMENTS

Non-linear sequence 3 was observed in network 5 (Table 4.5) and also resulted from the structural alignment in which a new organization (municipalities) was included in the network, to provide patients transportation to the ophthalmology centre. This structural alignment triggered two misalignments, one of capacity and one technical, the former associated with the latter, which consisted of the lack of knowledge about the availability of the transportation services. The subsequent alignment efforts included: two technical

4.3. Findings

alignments, in the form of the creation of a process to collect the required information (transport availability) and the creation of a negotiation process to align capacities; and a capacity alignment that resulted from the negotiation process, allowing the adaptation of the available resources (scheduling slots) to the capacity of the new members of the network, i.e., the transportation capacity of the municipalities.

CASCADING SEQUENCE C

Non-linear sequence 3 is also a cascading sequence of alignment (Table 4.6). In network 5, cascading sequence B, in which the municipalities were included in the network, created further capacity and technical misalignments, which in turn required additional capacity and technical alignment efforts. In cascading sequences B and C, the same alignment effort leads to multiple cascading effects, i.e., creates multiple misalignments that require further alignment efforts.

NON-LINEAR SEQUENCE 4: STRUCTURAL MISALIGNMENT TRIGGERS TECHNICAL ALIGNMENT

This non-linear sequence was observed in networks 1 and 7 (Table 4.5), in which traveling difficulties caused by the unfavourable nature of the networks (structural misalignment) were overcome with technical alignments. In network 1 some patients had difficulties traveling to the local hospital for treatment, and in network 7 the technicians had very limited time to perform the screenings in the farthest PCUs because of the long travel times. These difficulties were overcome by changing scheduling rules and work practices in network 1, and by changing work practice rules in network 7.

NON-LINEAR SEQUENCE 5: CAPACITY MISALIGNMENT TRIGGERS TECHNICAL ALIGNMENT

This fifth non-linear sequence was observed in several networks, in which a lack of resources (capacity misalignment) required technical alignment efforts. There were four variations of these technical alignment efforts: changing work practices, adapting the screening program, adopting complementary systems, and changing rules.

NON-LINEAR SEQUENCE 5.1: CAPACITY MISALIGNMENT TRIGGERS TECHNICAL ALIGNMENT OF WORK PRACTICES

The first variation of non-linear sequence 5 was observed in networks 1, 2, and 5 (Table 4.5). The lack of resources was causing delays in the screening program and the solution that was found to mitigate them was the adaptation of work practices (technical alignment). In the

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

specific case of networks 2 and 5, the technical alignment efforts emerged from the delays in the response of the screening program to the needs of the PCUs (capacity misalignment), perceived by the GPs as an absence of the program. The new work practice (technical alignment) was the only immediate adaptation that the local PCC group managers could make to meet the targets for quality of care for their patients (a yearly screening).

CASCADING SEQUENCE D

In the case of network 1, a cascading sequence of alignments (Table 4.6) started with a temporary lack of treatment capacity (capacity misalignment). To solve that misalignment, the hospital managers decided to create a new work practice (technical alignment), which led to a new capacity misalignment (lack of capacity to perform that new work task). The latter was then solved with the allocation of another team of secretaries (capacity alignment).

NON-LINEAR SEQUENCE 5.2: CAPACITY MISALIGNMENT TRIGGERS TECHNICAL ALIGNMENT
OF THE SCREENING PROGRAM

This variation of the fifth non-linear sequence was observed in networks 2 and 4 (Table 4.5). In network 2 the technical alignment was triggered by a capacity misalignment related to the reading tasks, while in network 4 it was triggered by a capacity misalignment related to the screening tasks. Both required a technical alignment of ScreenSoft.

CASCADING SEQUENCE E

Network 4 featured a cascading sequence with a technical misalignment that triggered a capacity misalignment (Table 4.6). An earlier technical alignment consisting of the formalization of the scheduling of extra patients (two extra patients per day) caused the technical misalignment, which in turn created the capacity misalignment in the screening tasks.

NON-LINEAR SEQUENCE 5.3: CAPACITY MISALIGNMENT TRIGGERS ADOPTION OF
COMPLEMENTARY SYSTEM

The delays in the communication of the results of the readings to the other organizations in the network, caused by insufficient capacity in the reading centre, could be reduced if part of the readings were performed automatically using appropriate software. However, this structural alignment had not yet been implemented by the end of our fieldwork, because the implementation managers had not yet been able to find a capable software.

4.3. Findings

NON-LINEAR SEQUENCE 5.4: CAPACITY MISALIGNMENT TRIGGERS TECHNICAL ALIGNMENT OF RULES

This final variation of the fifth non-linear sequence was observed in networks 5 and 6 (Table 4.5). In network 5, technical alignments of scheduling and evaluation rules were required to overcome a reduction of capacity in the ophthalmology centre, and to be able to keep performing the screening in time. In network 6, the lack of capacity in the reading centre triggered a technical alignment of scheduling rules.

CASCADING SEQUENCE F

A cascading sequence of alignments and misalignments was observed in network 5 (Table 4.6). The inability to perform the screening in time, a capacity misalignment created by a change in the operational context of the ophthalmology centre, triggered a technical alignment of scheduling rules in the centre, which solved the capacity misalignment. However, the change of scheduling rules created a new technical misalignment (a misevaluation of the PCUs), which further required a technical alignment effort (a change in the evaluation rules, i.e., the KPIs).

NON-LINEAR SEQUENCE 6: CAPACITY MISALIGNMENT TRIGGERS TECHNICAL MISALIGNMENT

The reading capacity misalignment of network 2 uncovered a technical misalignment (the technicians were not able to communicate their perceptions of treatment urgency), which triggered a final technical alignment (the implementation of a new functionality to allow the technicians to communicate their perceptions to the readers). This technical alignment did not solve completely the capacity misalignment, but certainly reduced effects. It was observed in networks 1, 2, 3, 6, and 7 (Table 4.5), i.e., all the networks in which the reading centre provided the reading service, but one (network 8, in which the collected data was scarcer).

CASCADING SEQUENCE G

Non-linear sequence 6 is also another cascading sequence of alignments following misalignments (Table 4.6). The initial capacity misalignment uncovered a technical misalignment, which in turn triggered a technical alignment. In two of the networks (1 and 2), this technical alignment was preceded by an improvised technical alignment.

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

NON-LINEAR SEQUENCE 7: CAPACITY MISALIGNMENT TRIGGERS STRUCTURAL ALIGNMENT

Due to the reduction of capacity in the ophthalmology centre of network 5, a structural alignment carried out in the first screening round had to be cancelled (Table 4.5). In other words, a capacity misalignment created by a change of context triggered a new structural alignment, cancelling the earlier structural alignment.

CASCADING SEQUENCE H

Non-linear sequence 7 is part of a larger cascading sequence of alignments (Table 4.6) which includes the structural misalignment related to the difficulties that the patients from PCC group 5-b faced in traveling to the ophthalmology centre. In both this cascading sequence and cascading sequence F (multiple cascading effects from the same capacity misalignment), the influence of the dynamic evolution of the implementation and operation context, requiring constant monitoring and the willingness to implement further alignment efforts, stands out. In this case, an initial structural misalignment that had apparently been solved re-emerged when the conditions that had initially enabled its solution changed, forcing the cancelation of the solution.

CASCADING SEQUENCE I

In network 1 a new structural misalignment was created by the centralization of the screening in a single PCU. In this cascading sequence, the structural alignment that solved the initial structural misalignment created a new structural misalignment, not yet overcome by the end of our fieldwork (Table 4.6).

CASCADING SEQUENCE J

The sequence of alignments (of reallocations of work) observed in network 3 illustrates another cascading sequence, in which a structural alignment effort that appeared to be best positioned to solve a misalignment (a second alignment effort of moving the screening to a PCU located at the centre of the PCC group), was only partially successful.

CASCADING SEQUENCE K

Finally, in network 7, an unexpected cascading sequence was identified (Table 4.6). A planned structural alignment effort (reallocation of work) ended up not being implemented due to a technical misalignment (the impossibility of providing the internet connections required to operate the screening) that was identified beforehand.

4.4 NON-LINEAR AND CASCADING SEQUENCES OF ALIGNMENT

The findings reported in the previous section provide rich information concerning sequences of alignment during the implementation of technologies in networks of organizations, in particular regarding non-linear and cascading sequences. In this section, they are discussed in three parts:

- Findings concerning non-linear sequences of alignment, illustrated in Figure 4.2, leading to a set of propositions pointing to the most important contributions of this study for the understanding of those sequences
- Findings concerning cascading sequences of alignment, focused on their causes and characteristics, and whether or when they may or may not be desirable
- Findings regarding the complexity of implementation management when the adopter of the technology is a network of organizations.

The sequences of alignment observed in our research are illustrated in Figure 4.2. They always start from a state of misalignment between the network and the technology, and with efforts of alignment between both throughout the implementation hopefully progress to a state of alignment. In the state of alignment, the network and the technology meet, meaning that the technology becomes integrated in the routine operations of the adopter. Figure 4.1 shows the basic structure of the illustrations presented in Figure 4.2.

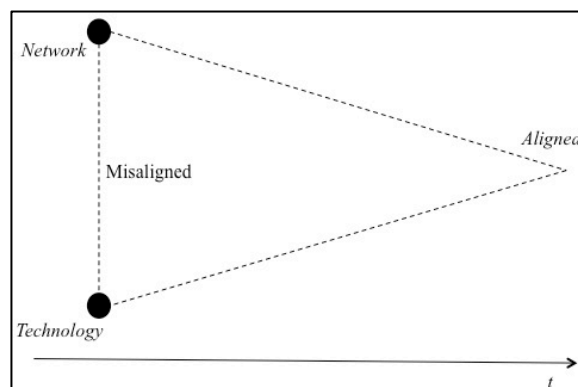


Figure 4.1 – Structure for the representation of sequences of alignment found in our research

4. Sequences of alignment between technologies and adopters: Case research of implementations of a new health screening program

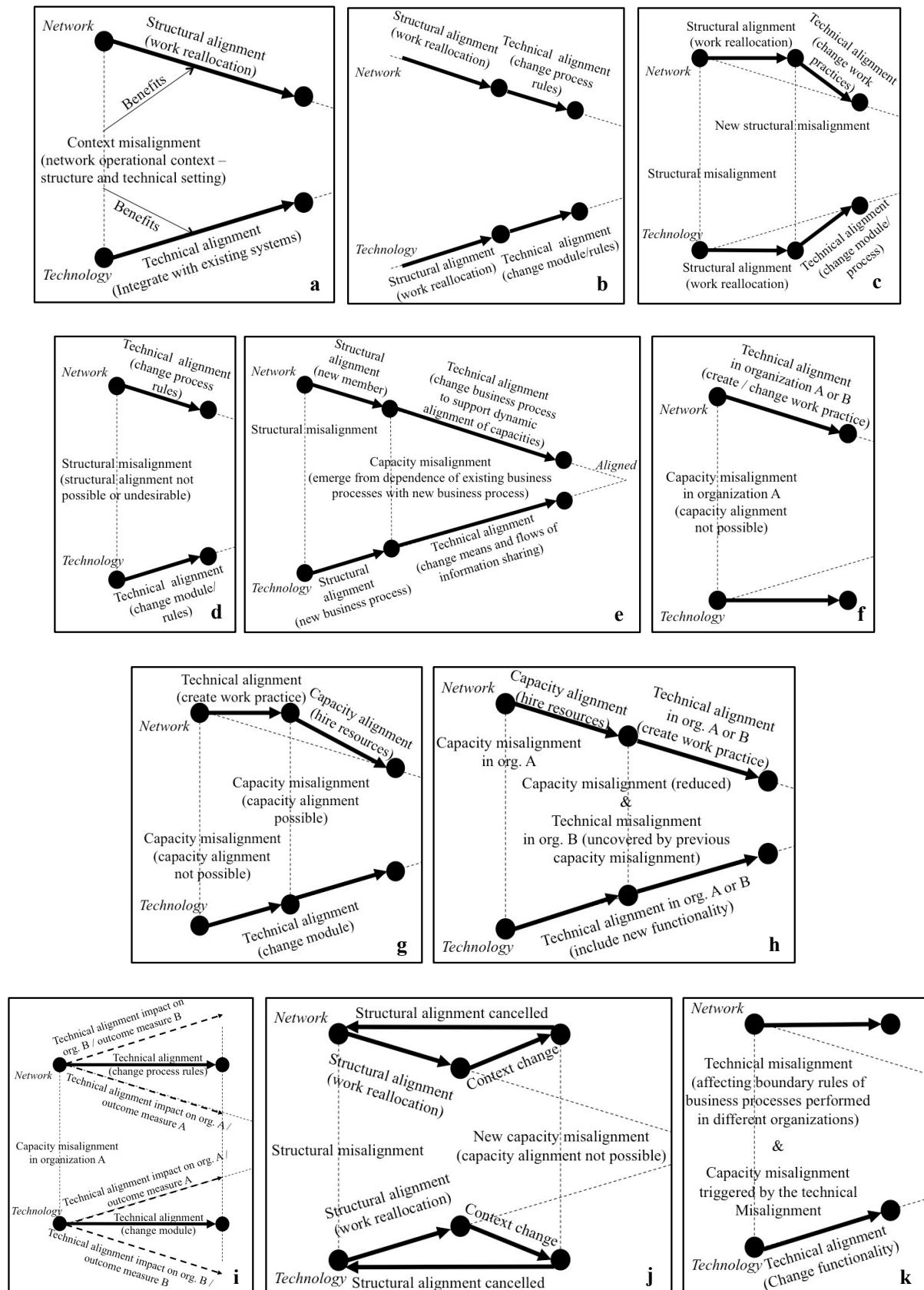


Figure 4.2 – Illustrations of findings emerging from the analysis of the non-linear sequences of alignment

4.4. Non-linear and cascading sequences of alignment

4.4.1 NON-LINEAR SEQUENCES OF ALIGNMENT

Non-linear sequence 1 begins with a misalignment of the technology and the local context in which the network operates. The findings show that such context misalignments require changes in the network structure and the technical setting (namely the information systems that support network operations) planned to use the technology.

In network 4, the already existing local screening program had a network structure different from the one planned for the new regional screening program. Structural alignment efforts consisting of changes in the work allocation of the local network structure allowed its adaptation to the new screening program, and changes to the structure planned for the new regional screening program allowed taking advantage of the routines that had been created by the previous screening program. Similarly, in network 5, the centralization of the screening was due to the investment in new machines made by the new ophthalmology centre, while also leveraging its staff's high motivation to use them.

A technical alignment effort also emerged in network 4 because the information system that supported the previous screening program (OphthalSoft) was only used by the local hospital, and according to the new network structure, other organizations (PCUs) also needed to use the new system that supported the screening program. OphthalSoft was thus kept to take advantage of its integration with the hospital's operations, but it was also integrated with the new information system that enabled the operations of the other organizations of the network.

To summarize, context misalignments require other classes of alignment efforts (structural or technical). The context of the implementation cannot be changed directly, and the alignment efforts should also be designed to benefit from any advantages brought by the local context. The class of efforts required to overcome context misalignments seems to depend on their scope of influence: in the analysed instances, the impact was on both the structure of the network and its technical setting, and therefore the required efforts were both structural and technical. These conclusions, illustrated in Figure 4.2.a, lead to the following propositions:

Pl1a. When implementing technologies in networks of organizations, context misalignments between the technology and the operational setting of the network are overcome by structural alignment efforts, to improve the implementation outcome.

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

P1b. When implementing technologies in networks of organizations, context misalignments between the technology and the operational setting of the network are overcome by technical alignment efforts, to improve the implementation outcome.

The structural alignment efforts carried out to solve context misalignments create further technical alignment opportunities (non-linear sequence 2.2). The reallocation of work tasks to organizations with better resources (hospitals) enabled further technical alignments, in the form of inclusion of new business processes (examine different health conditions). Although the hospitals require patients to travel longer distances than the PCUs, they provide additional capabilities which enable a better screening (implementation outcome), taking advantage of the prior structural alignments.

Similarly, a centralization of (part of) the business processes or work tasks (a reallocation of work) created the opportunity to improve operational rules (non-linear sequence 2.1). The definition of the business process rules was concentrated in a single decision maker (an individual or an organization), while previously, with the business process distributed and performed by different organizations, each one could have different rules. New rules could then be designed to provide a better service (for instance, making it more flexible by accepting some extra scheduling slots per day) or to improve the efficiency of the business process.

The fact that the centralization of a business process leads to more formalized rules has been suggested in the network theory literature. [Barros de Oliveira \(2013\)](#) proposes that “monitoring organizations”, also called orchestrators ([Dhanarag and Parkhe, 2006](#), [Levén et al., 2014](#), [Paquin and Howard-Grenville, 2013](#)), foster cross-understanding and mutually agreed norms, which in turn lead to cohesive configurations of the network, i.e., a network’s central organizations promote consensual norms that lead to, or reinforce, a centralized configuration of the network. Similarly, [Provan et al. \(2009\)](#), in line with previous research, hypothesize that central organizations have a “gatekeeping” role in the network, influencing the decisions of the network, although this relationship of influence takes time to be fully developed. The work of [Tracey et al. \(2014\)](#) is even closer to the discussion of the previous paragraph, with the authors arguing that a centralized network configuration promotes the emergence of hierarchical governance practices, which involve setting restrictions that regulate ongoing interactions.

4.4. Non-linear and cascading sequences of alignment

Governance and operations are two different network levels, according to [Turner and Keegan \(1999\)](#). The RHA, an entity that is external to the operations of the network, governs the networks that are implementing the regional screening program using the Network Administrative Organization mode of governance defined by [Provan and Kenis \(2008\)](#). At the operations level the RHA has a reduced participation and the networks have different arrangements with different degrees of centralization (from multiple to just one or two central screening locations). Findings from network theory address governance, whereas our findings address the operational level. We argue that a phenomenon similar to the one reported in the network theory literature is observed at the operational level, i.e., when operations are centralized, the hub organization increases its influence and may promote restrictions or new rules that regulate the operational interactions. The previous findings, illustrated in Figure 4.2.b, lead to the following proposition:

P2. When implementing technologies in networks of organizations, structural alignment efforts in the form of reallocation of work among the organizations in the network lead to the implementation of technical alignment efforts in the form of changes to process rules, to improve the implementation outcome.

Reallocation of work may also bring disadvantages, because new misalignments can emerge, as was the case in non-linear sequence 2.1 of network 8. The reallocation (centralization) of work (structural alignment), triggered by a structural misalignment consisting of difficulties in transporting the screening machine, created a new structural misalignment in the form of difficulties for patients to travel to the screening location.

The most obvious solution for this new misalignment would be a decentralization of the screening (a new reallocation of work), cancelling the previous structural alignment effort. However this would also make the initial misalignment reappear, so other options were investigated. Interestingly, the observation of social behaviours (patients sharing transportation to the screening site) suggested the new solution, a technical alignment (a scheduling rule establishing the grouping of patients from the same village in consecutive appointments). In this case, the new technical alignment (of business process rules) not only emerged from an opportunity created by a previous structural alignment, but was in fact also required for that alignment not to be cancelled, thus also preventing the reappearance of an initial structural misalignment (Figure 4.2.c).

4. Sequences of alignment between technologies and adopters: Case research of implementations of a new health screening program

Non-linear sequence 4 includes structural misalignments, triggered by the local context, that could not be solved by structural alignments, either because they would be outside the scope of the implementation (network 1), or because they would lead to other structural misalignments (network 7), similarly to the instance reported in the previous paragraph. In these cases, technical alignments of business process rules and/or practices (setting or adapting scheduling rules, e.g., to start checking patient availability, or to stop the screening of patients scheduled for different dates) may reduce the negative impact of the structural misalignments (Figure 4.2.d). The following proposition emerges from the previous findings:

P3. When implementing technologies in networks of organizations, structural misalignments are overcome by technical alignment efforts, to improve the implementation outcome.

Including in the network a new member with a new business process (a structural alignment), in order to overcome a structural misalignment, will probably bring along technical and capacity misalignments which will require further alignment efforts, as in the case of non-linear sequences 2.3 and 3 of network 5. This cascade was caused by the need to integrate the new business process, a new transportation service, in the overall operations of the network (the screening process). Technical alignments of means or flows of information sharing will most likely be required to support the integration, because of the important support role that the exchange of information between the network members has for its business processes ([Hadaya, 2009](#), [Power and Singh, 2007](#), [Sigala, 2013](#), [Thun, 2010](#)). An example is the adaptation of the letter in non-linear sequence 2.3, to inform the patients about the transportation service. Without sharing this information in the letter, the new service (business process) would not be effective and the overall operations of the network (screening program) would not benefit so fully from the new business process.

It is also possible that the capacities of the new and existing members of the network need to be aligned, in particular if any interdependencies exist between the new and the existing business processes. In non-linear sequence 3, the transportation capacity of the new organizations (municipalities) placed limits on the screenings that could be performed each day, and had to start being considered in the definition of the screening slots. The need for capacity alignment triggered an additional technical alignment in the form of changes to another business process (the capacity negotiation process), which not only enables the alignment of capacity between the members of the network at the beginning of each screening round, but also integrates the new and existing organizations and business

4.4. Non-linear and cascading sequences of alignment

processes in the network. These findings, illustrated in Figure 4.2.e, lead to the following propositions:

P4. When implementing technologies in networks of organizations, structural alignment efforts in the form of the integration of new members and new business processes require the implementation of technical alignment efforts in the form of changes to the means and flows of information sharing, to improve the implementation outcome.

P5. When implementing technologies in networks of organizations, capacity alignment efforts in the form of temporary alignments of capacities between the members of the network require technical alignment efforts in the form of changes to business processes, to improve the implementation outcome.

Non-linear sequence 5.1 suggests that some technical alignment efforts seem to emerge as solutions to overcome delays caused by capacity misalignments, when corresponding capacity alignment efforts are not possible. Although they may not solve the capacity misalignment, they contribute to reduce the impacts of the delays. They can consist of changes to work practices (as in network 1, which stopped discharging the most severe patients from treatment, or as in networks 2 and 5, which went back to their old systems to refer patients for screening), or the creation of new work tasks (network 1 introduced a new transitory work activity to solve a temporary capacity misalignment).

It may happen that the capacity misalignment occurs in one organization, but the technical alignment efforts are only possible in other organizations affected by the impact of that misalignment, as was the case in networks 1, 2, and 5. In network 1, the capacity misalignment in the reading centre (located in network 2) was causing a delay in the beginning of the treatments, and, therefore, the ophthalmology physicians of the local hospital stopped discharging the most severe patients from treatment, to avoid it taking too long for them to restart their treatments if needed. The sudden lack of capacity to perform the screening on time in network 2 was caused by the merger of two PCC groups, and in network 5 it was caused by the reduction of the number of professionals in the ophthalmology centre and the significant increase in the number of patients. These capacity misalignments caused delays in the screenings, and the PCUs that were affected (which had no information about the causes of the delays) decided to start referring their patients directly to ophthalmology appointments in the local hospital, for the same screening (technical alignment of the

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

business process), which was the only alignment effort within their reach that could contribute to minimizing the impacts of the delays.

In the previous cases, capacity alignment efforts (increasing the number of professionals) were not possible, and therefore the teams or organizations affected by the capacity misalignment were forced to adjust their work practices or create new ones, so that their patients could be screened or treated on time. These findings are illustrated in Figure 4.2.f.

These previous technical alignment efforts may be implemented in the organization with the capacity misalignment, or in other organizations of the network affected by the impact of the misalignment (as in the previous cases). The creation of a new temporary work task, in non-linear sequence 5.1 of network 1, illustrates the case of a capacity misalignment that emerged in one organization of the network, as a result of the technology being used in a network context, and was solved inside that organization.

These technical alignment efforts may be implemented in the organization with the capacity misalignment, or in other organizations of the network affected by the impact of the misalignment (as in the previous cases). The creation of a new temporary work task, in non-linear sequence 5.1 of network 1, illustrates the case of a capacity misalignment that emerged in one organization of the network, as a result of the technology being used in a network context, and was solved inside that organization. The local hospital stopped performing treatments for the screening program, but the remaining organizations in the network continued their activities (screening and reading). When the hospital restarted the screening, its capacity was insufficient for the list of patients waiting for treatment, and a new work task was created (a technical alignment) to address the capacity misalignment upstream in the business process workflow, consisting of secretaries filtering patients before scheduling them. However, the technical alignment also brought upstream the capacity misalignment (the number of secretaries was insufficient to perform the filtering task on time), which ended up being solved with a capacity alignment (hiring more resources to do the job). A cascading effect was created to achieve a rapid response and accelerate the elimination of a temporary problem. The transfer of capacity misalignments from locations where their resolution is not possible to locations where it is, may be a useful implementation management intervention. These findings are illustrated in Figure 4.2.g. The following two propositions emerge from the previous findings illustrated in Figure 4.2.f and in Figure 4.2.g.

4.4. Non-linear and cascading sequences of alignment

P6. When implementing technologies in networks of organizations, capacity misalignments are overcome by technical alignment efforts, to improve the implementation outcome.

P6.1. Capacity misalignments are overcome by introducing new work tasks that then enable the implementation of capacity alignment efforts, to improve the implementation outcome.

When a capacity alignment effort is not sufficient to solve a capacity misalignment, due to the high level of capacity required, a technical alignment effort of functionalities (the inclusion of a new functionality or the improvement of the efficiency of an existing functionality) may create the conditions to indirectly increase the capacity of the allocated resources. This was observed in non-linear sequence 5.2 of network 2, in which the technical alignment consisted of the inclusion of the possibility to perform the readings remotely.

Technical alignments of business processes can also be an important complement for capacity alignment efforts. This was observed in non-linear sequence 6, in which the inclusion of a new work activity (prioritizing the patients for the evaluation by the readers) contributed significantly to reduce the impact of the reading delays. A capacity misalignment can also uncover technical misalignments (the technicians were not able to prioritize the patients) that initially might seem secondary, but later emerge as important partial solutions (for the delays of the reading centre). Similarly to the discussion of proposition 6 (Figure 4.2.f), the technical misalignment emerged in organizations (PCC groups) different from the one in which the capacity misalignment was observed (local hospital of network 2). This geographical distribution of misalignments raised difficulties to the identification of the appropriate technical alignment effort, because it had to be proposed and discussed among the management structures of the different organizations (PCC groups of different networks, RHA, and reading centre) before being implemented. The technical alignment actually emerged as an improvised and semi-informal technical alignment in networks 1 and 2 before the final technical alignment was implemented.

Technology evolution can also provide new solutions that may contribute to solve existing capacity misalignments, by automating some tasks as was envisioned in non-linear sequence 5.3, even though in that case the existing solutions did not yet have sufficient performance to be adopted. The previous findings are illustrated in Figure 4.2.h and lead to the following proposition:

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

P7. When implementing technologies in networks of organizations, capacity misalignments are overcome by structural alignment efforts, to improve the implementation outcome.

Technical alignment efforts intending to solve capacity misalignments may have different impacts on different measures of the implementation outcome. For this reason, they have to be evaluated along all the dimensions of the implementation outcome (namely the operational dimensions) before being carried out. In non-linear sequence 5.4 of network 5 a technical alignment of business rules (stopping accepting rescheduling requests) implemented by one organization (ophthalmology centre) reduced the impact of its capacity misalignment by improving the conditions for it to perform all the screenings in one year as targeted by the screening program (a service efficiency measure of the implementation outcome). However, the technical alignment effort did not completely remove the impacts of the capacity misalignment, because stopping accepting rescheduling requests also prevented patients who missed their appointments from being screened at a later date. As a consequence of this alignment effort, on one hand the required capacity became very stable, because each patient only had one appointment per round and the number of required screening slots per round became easy to predict, but on the other hand there was no longer a guarantee that all patients would be served (a service effectiveness measure of the implementation outcome).

Still in the scope of non-linear sequence 5.4 of network 5, the capacity misalignment and its respective technical alignment effort also had an impact in other organizations (the PCC groups started to be misevaluated by the RHA). As a consequence, the evaluation system of the PCC groups was changed and the KPIs related to the screening were removed (a technical alignment). Analysing the ultimate impact of the ophthalmology centre's technical alignment on the PCC groups' KPIs, the time that it takes to complete one round of screenings may have improved, but the ratio between the number of patients screened and the number of patients selected for screening certainly worsened (this may be one of the reasons for the decline in participation in 2013 – Table 4.3).

Nevertheless, a similar technical alignment observed in non-linear sequence 5.4 of network 6 (a small reduction in the number of screenings scheduled each day) had a positive effect on the usage of the reading capacity (readings stopped being delayed) and the impact on screening performance was not significant (the time that it takes to complete one round of screenings and the number of patients screened remained similar). This suggests that it can be beneficial to assess the impact of these technical alignments on other tasks and on the

4.4. Non-linear and cascading sequences of alignment

performance of the other dimensions of the implementation outcome (particularly in other organizations) when deciding whether to carry them out or not. Nevertheless, the case of network 6 was simpler to assess than the case of network 5, because the selection, scheduling, and exam were all performed by the PCUs. These findings are illustrated in Figure 4.2.i.

Non-linear sequence 5.1 in networks 2 and 5 revealed another relevant finding: some capacity misalignments are triggered by changes in the context of the implementation (the merger of two PCC groups, which increased the area of influence of the local hospital, in network 2, or the significant increase of the workload in network 5). Capacity misalignments caused by context changes can also lead to the cancellation of previous structural alignment efforts enabled by higher levels of capacity, and carried out to solve a prior structural misalignment. This was observed in non-linear sequence 7 of network 5, in which a capacity reduction forced the ophthalmology centre to focus on its most important local activities and discontinue other tasks, as was the case of the screening in a local PCU for PCC group 5-b.

These observations provide good illustrations of the dynamic nature of implementations ([Leonard-Barton, 1988a](#)), namely of how changes in the context throughout the implementation process change the state of alignment between the technology and the adopter (network), requiring further alignment efforts, or even the cancellation of previous alignment efforts as illustrated in Figure 4.2.j.

The propositions put forward in this section concern relations between alignment efforts and/or misalignments in non-linear sequences of alignment, and are represented in Figure 4.3. Examining the findings and the illustration of the propositions, technical misalignments stand out as the only class of misalignments that do not trigger non-linear sequences of alignment. It also stands out that technical alignment efforts are triggered by all other classes of misalignments (context, structural, and capacity) and even by all other classes of alignment efforts (structural and capacity). We speculate that technical misalignments do not trigger non-linear sequences of alignment because technical alignments are easier to perform than the other classes of alignment efforts, because they do not require investing in resources of changing structural relations of the network.

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

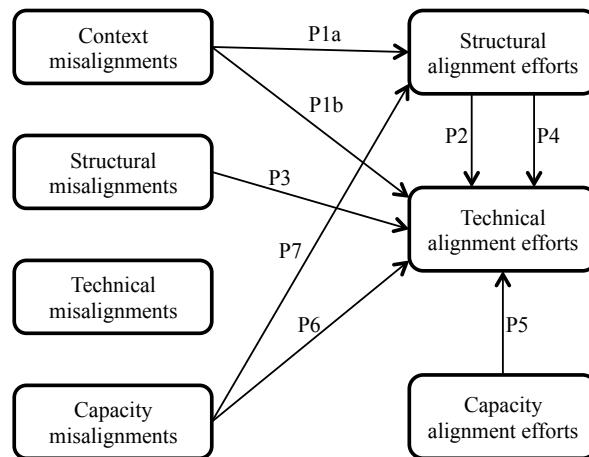


Figure 4.3 – Propositions about non-linear sequences of alignment

Nonetheless, technical misalignments in which rules to limit the amount of work sent between organizations are missing, may trigger capacity misalignments. For example, in non-linear sequence 5.2 of network 4, ScreenSoft did not limit the number of extra patients that could be scheduled each day, but the hospital capacity only allowed 2 extra patients (scheduling rule). This technical misalignment – the absence of a rule defined for a business process (scheduling the patients) in the support system – had an impact on the capacity required to carry out the task of the following business process (screening the patients) – a capacity misalignment. The solution for both technical and capacity misalignments is a technical alignment of the technology to correct whatever may be creating the technical misalignment (implement a software functionality to limit the number of extra patients scheduled each day), i.e., the solution lies in solving the original misalignment (illustrated in Figure 4.2.k). In a network, this phenomenon is particularly complex, as observed in non-linear sequence 5.2 of network 4. The technical misalignment affects a business process performed by the secretaries of one organization (PCC group) and creates a capacity misalignment for the technicians of another organization (local hospital). The technical alignment required to overcome these misalignments becomes more important in this setting than in a single organization, in which the communication between the two teams would be easier and possibly sufficient to overcome the capacity misalignment. This phenomenon is therefore expected to be more significant in networks of organizations.

4.4.2 CASCADING SEQUENCES OF ALIGNMENT

In general, cascading effects during sequences of alignment occur due to: a) the emergence of an opportunity to improve the outcome of the implementation through further alignments,

4.4. Non-linear and cascading sequences of alignment

resulting from an earlier alignment; or b) the need to find a solution for further misalignments, b.1) created by an earlier alignment effort, b.2) uncovered by a prior misalignment, or b.3) created by a change of context. These different origins of cascading effects have been illustrated in the findings, and are reported in Table 4.7.

Origins of cascading sequences of alignment		Cascading sequences observed for each origin
a) Emergence of an opportunity to improve the outcome of the implementation through further alignments, resulting from an earlier alignment effort		A (some cases reported)
b) Need to find a solution for further misalignments	b.1) created by an earlier alignment effort	A (remaining cases reported) B, C, D, E, F, I, and J
	b.2) uncovered by a prior misalignment	G
	b.3) created by a change of context	H

Table 4.7 – Cascading sequences of alignment and their origins

4.4.2.1 THE DEVELOPMENT OF CASCADING SEQUENCES OF ALIGNMENT

The analysis of the cases that feature cascading sequence A suggests that the same alignment effort, besides possibly having different effects on the implementation outcome, as discussed concerning the findings illustrated in Figure 4.2.j, may also have different effects in different networks but in the end lead to the same subsequent alignment efforts.

This cascading sequence was observed in networks 1, 4, and 8. Networks 1 and 8 started the cascading from a structural misalignment (difficulties in transporting the screening machine) and network 4 from a context misalignment (the existence of a previous local screening program). In the three networks the following step was the implementation of the same structural alignment effort (the centralization of the screening). Network 4 was already prepared for a centralization of the screening, because that was the structure of the previous local screening program. Networks 1 and 8, however, were not and a new structural misalignment emerged (difficulty of some patients to travel to the screening site). In network 8 this new misalignment led to the final technical alignment of cascading sequence A3, while in network 1 it was not solved, as reported for cascading sequence I.

The technical alignment effort (change of scheduling rules) carried out in network 8 to overcome the new structural misalignment was also carried out in networks 1 and 4, but for a different reason. In networks 1 and 4, the aim of the technical alignment was improvement – the performance of one task (scheduling) in network 1, and the implementation outcome (patient participation) in network 4. It emerged from an opportunity triggered by the structural alignment effort and not from the need to overcome a new misalignment, as in network 8. The different effects of the same structural alignment effort in different networks, triggering an opportunity for improvement (networks 1 and 4) or creating a new

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

misalignment (networks 1 and 8), may therefore be explained by a combination of the origin of the alignment effort and the motives behind the following alignment efforts.

When the alignment effort emerges from context misalignments and the network is prepared for it, it triggers the opportunity to improve the outcome of the implementation. When it emerges from structural misalignments and the network is not prepared for it, new misalignments emerge. In the latter, the decisions about the following alignment efforts depend on the motivation to overcome the new misalignment or to improve the performance of specific tasks.

Cascading sequences B and C, and cascading sequences F and H show that a single alignment effort may have multiple cascading effects, i.e., create multiple cascading sequences. This may be a useful indicator of the complexity of the alignment effort: when an alignment effort triggers multiple cascading effects, its implementation is more complex than when it triggers only one cascading sequence, or when there is no cascading sequence.

Another observation related to cascading sequence C is the fact that when a new member is introduced in the network and brings a new business process (a new service), a cascading sequence of misalignments and alignment efforts emerges, as previously discussed concerning non-linear sequence 3 and proposition 4 (Figure 4.2.e).

Cascading sequences F and H also reveal that cascading effects may result from changes in the implementation context that require further alignment efforts. External variables may change throughout the implementation process, modifying the alignment status of the implementation. These findings highlight the very dynamic nature of networks, as already discussed regarding the findings illustrated in Figure 4.2.i and in Figure 4.2.j.

Finally, in cascading sequence G, temporary improvised alignment efforts suggest (the need for) further and definitive alignments. In this case a final technical alignment effort (inclusion of a new functionality) started off as a partial and complementary solution for an initial capacity misalignment (lack of reading capacity), as was mentioned in the discussion of findings illustrated in Figure 4.2.k, and provided an opportunity to improve a business process with a new means for information sharing (technicians sharing their perceptions of treatment urgency with the readers).

4.4. Non-linear and cascading sequences of alignment

4.4.2.2 MANAGING CASCADING SEQUENCES OF ALIGNMENT

Cascading sequence J brings into focus the fact that sometimes alignment efforts may not solve or significantly reduce the misalignment that they are targeting, thus leading to a cascading sequence of experiments of alignment efforts. In the case of the screening program, before changing the structure of the network, it would have been beneficial to have the transportation system that would provide the transportation of the patients to each possible location (PCU) evaluated. Cascading sequence K is a good illustration of the importance of a careful consideration of all the variables that influence the system, and in particular of the specific alignment effort under evaluation. In this sequence, the alignment effort (decentralization of the screening to local councils) was cancelled due to external variables (context conditions – lack of secure internet connections) that made it unfeasible. These findings suggest that alignment efforts in networks of organizations must be carefully planned before being carried out, taking into consideration all the variables that influence the implementation system, otherwise they may not be effective in solving the misalignment. Such previous analysis may help avoid cascading sequences, and their costs.

Nevertheless, there are situations in which, in spite of a careful planning of the alignment effort, a cascading sequence of alignments can not be avoided, because the alignment effort brings unavoidable additional misalignments. This was the case of cascading sequence C, in which the structural alignment triggered a capacity misalignment. When the alignment effort can benefit from complementary alignment efforts, the cascading sequence should also not be avoided. That is the case of cascading sequence G, in which a technical alignment carried out to overcome a technical misalignment which had been uncovered by a prior capacity misalignment, also contributed to overcoming this earlier misalignment.

Cascading sequence D resulted from an intention to provide a quick response to an initial temporary capacity misalignment (lack of ophthalmology physicians to respond in time to a long list of patients waiting for treatment). Initially, the alignment efforts included in the cascading sequence were seen as temporary, but one of them was also found to improve a business process, and for that reason became definitive. This cascading sequence also shifted the initial misalignment to another group of professionals for which an alignment effort could be carried out, suggesting that a cascading effect can be an effective strategy to move misalignments and simplify their resolution.

4.4.3 NETWORK LEVEL COMPLEXITY FOR IMPLEMENTATION MANAGEMENT

The non-linear and cascading sequences of alignment previously discussed were observed at the network level of the implementations, i.e., they affected or were triggered by multiple organizations in the network. Our findings suggest that their management becomes more complex than would be the case if the implementation occurred at an organizational level, as will be discussed in the following paragraphs.

According to the implementation literature, when the adopter of the technology is a single organization, misalignments are resolved internally, by the management structure or by negotiating with the provider of the technology ([Ansari et al., 2010](#), [Basoglu et al., 2007](#), [Choi and Moon, 2013](#), [Edmondson et al., 2001](#), [Greenhalgh et al., 2004](#), [Leonard-Barton, 1988a](#), [Rogers, 2003](#), [Wei et al., 2005](#)). However, when the adopter is a network of organizations, alignment efforts frequently have to be negotiated between members of the network ([Harty, 2005](#), [Hellström et al., 2011](#), [Hinkka et al., 2013](#), [Kurnia and Johnston, 2000](#), [Lee et al., 2005](#)), which have independent power structures that require the orchestration of decisions ([Dhanarag and Parkhe, 2006](#), [Goes and Park, 1997](#)), making the decision process more complex.

The need to negotiate alignment efforts is observed in most of the non-linear and cascading sequences identified in this study. The structural and technical alignments triggered by the initial context misalignment of non-linear sequence 1 and cascading sequences A.2, B, C, E, and H, had to be negotiated between the local hospital and the RHA before being carried out. The software supplier also had to be involved in the negotiations of the technical alignment to integrate ScreenSoft with OphthalSoft.

The reallocation of work among organizations (centralization), in non-linear sequences 2.1 and 2.2, and cascading sequences A, C, I, and J, was negotiated and agreed between the RHA, the PCUs, and the local hospitals whenever the screening was centralized in the hospitals. Similarly, the cancelation of a previous reallocation of work (decentralization), in non-linear sequence 7 and cascading sequence H, had to be negotiated by the PCUs and the local hospital, because both were affected by the alignment.

The integration of a new member in the network, in non-linear sequences 2.3 and 3, and in cascading sequences B and C, had to be negotiated between the PCUs (who led the negotiations), the RHA, the local hospital, and the new members (municipalities).

4.4. Non-linear and cascading sequences of alignment

In distributed cascading sequence G and non-linear sequence 6, a misalignment in one organization (reading centre) uncovers a misalignment in other organizations (PCUs) and triggers complementary alignment efforts in all the organizations (reading centre and PCUs). These alignment efforts were also negotiated between those organizations (reading centre and PCUs) and the implementation manager (RHA) before being carried out. All these negotiations take time, due to the distribution of management (power) among different organizations that are separated geographically and have independent managerial structures. In fact, in cascading sequence G and non-linear sequence 6 the length of the negotiations provided enough time for improvised solutions to emerge.

In addition to the negotiation of alignment efforts, bottleneck effects also stood out in our analysis as a network-specific managerial challenge. In a network, misalignments in one organization can occasionally make it a bottleneck in shared business processes and workflows, and thus affect other organizations. When the misalignment cannot be solved by its “owner”, the other affected organizations have to find alternative alignment efforts to mitigate the impact of the bottleneck, as was the case in non-linear sequence 5.4 of network 6. On one hand, the network makes the implementation process easier for the “owner” of the misalignment, because it does not need to develop its own efforts (so much) to overcome the misalignment. At the same time, on the other hand, the network complicates the implementation process for the other organizations affected by the misalignment, which, unable to act directly on the cause of a misalignment located in a different organization, have to develop their own creative alignment efforts to mitigate its impact.

When the misalignment is caused by the unfavourable nature of the network, i.e., when it would not exist if its “owner” were implementing the technology alone, it may be solved within the “owner”. In non-linear sequence 4, the geographic distribution of the patients served by the PCUs (networks 1), or the geographic distribution of the PCUs (network 7), i.e., the unfavourable geographically dispersed nature of the network, created travelling difficulties (structural misalignment). This structural misalignment of the network required technical alignment efforts by the local hospitals experiencing its effects, to mitigate the impact of the unfavourable nature of the network.

Similarly, in non-linear sequence 5.1 of network 1 and cascading sequence D, the organization with the temporary misalignment (local hospital) paused the implementation process due to internal policy issues, while the remaining organizations (PCUs and reading

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

centre) carried on with their activities. As a consequence, when the local hospital solved its internal policy issues and restarted the implementation, a capacity misalignment emerged, which was then solved by alignment efforts in the hospital. In these three cases, the misalignment resided in a single organization, and was solved within that organization, but was due to the implementation taking place in a network instead of that single organization.

In other cases, the alignment efforts carried out by the organization in which a misalignment was observed were not negotiated with the other organizations in the network. Those alignment efforts had a negative impact in some of the screening implementation outcome metrics, affecting other members of the network. Non-linear sequence 5.4 of network 5 illustrates a non-negotiated technical alignment effort carried out by a single organization (local hospital) with impact on several other organizations in the network (PCUs). The alignment solved the local misalignment (of the hospital) but did not address the impact of the misalignment in the other organizations (PCUs) and actually worsened their performance (influencing their KPIs negatively), forcing further alignment efforts and negotiations between them and the implementation manager (RHA).

A final case illustrating the network-level complexity of implementations is non-linear sequence 5.2 of network 4. A rule created by one organization (local hospital) was not followed by other organizations (PCUs), creating a capacity misalignment for the former, which was then solved with a technical alignment effort that enforced the rule for the other organizations. This suggests that there may be alternatives to negotiation, when the organization with the misalignment has some form of control over its causes.

4.5 CONCLUSIONS

This paper contributes to the implementation management literature by bringing to light evidence about the reasons, consequences, and management of sequences of alignment, namely non-linear and cascading sequences, in implementations of technologies in networks of organizations.

A multiple case research of eight implementations of a new health screening program in networks of healthcare providers located in the North of Portugal was the main source of evidence for this study. Our aim was to describe and characterize non-linear and cascading effects observed during sequences of alignment between the technology (health screening

4.5. Conclusions

program) and the adopter (networks of organizations), also called mutual adaptations by [Leonard-Barton \(1988a\)](#).

This research work also contributes to network theory. Some of our findings reveal that the relation between centralization and promotion of rules or norms that govern the network, already theorized in that literature concerning the governance level of the network, is also observed at the operational level of the network. When the operations are centralized, the hub organization increases its influence and may promote restrictions that regulate the operational interactions between organizations of the network.

Three research questions were proposed: *“How do non-linear and cascading sequences of alignment between a technology and a network of organizations arise during implementation projects?”*, *“What are the consequences of non-linear and cascading sequences of alignment in the implementation process?”* and *“How are non-linear and cascading sequences of alignment managed during implementations of technologies in networks of organizations?”*. These questions are answered throughout Section 4.4, namely in the propositions that result from the analysis of non-linear sequences of alignment and in the discussion of the cascading sequences of alignment. The findings provide a rich picture of the challenges for the management of implementations in networks of organizations, in particular of sequences of alignment. Non-linear and cascading efforts are frequently part of the same sequence of alignments, as can be realized from the regular references to cascading effects during the discussion of some non-linear sequences, and from the fact that almost all observed cascading sequences include non-linear sequences of alignment.

In the following paragraphs we compile the conclusions retrieved from the findings, summarizing the discussion presented in Section 4.4 and pointing some directions for future research. In general, future research is needed to confirm these findings in other contexts of implementation, namely for other implementations of similar health screening programs in the same or in other networks of healthcare providers, and for implementations of other technologies in other networks of organizations, including other industries.

4.5.1 REASONS FOR NON-LINEAR AND CASCADING SEQUENCES

Non-linear sequences of alignment generally arise from alignments derived from other types of alignments or misalignments, or from alignments that are substituting or complementing

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

other types of alignments or misalignments. The specific reasons that were found for the emergence of non-linear sequences of alignments where:

- The existence of a context misalignment at the beginning of the implementation (proposition 1, Figure 4.2.a)
- The opportunity to improve the outcome of an activity, or the outcome of the implementation, triggered by an alignment of another class (proposition 2, Figure 4.2.b)
- The impossibility of solving a misalignment with an alignment of the same class (proposition 3, Figure 4.2.c, proposition 4, Figure 4.2.d, proposition 7, Figure 4.2.f, and proposition 9, Figure 4.2.h)
- The cascading effect of an alignment effort or a misalignment (propositions 5 and 6, Figure 4.2.e, proposition 11, Figure 4.2.j, and proposition 12, Figure 4.2.k)
- The opportunity to carry out an alignment effort that transfer a misalignment of another class from a location where it cannot be solved to a location where it can be solved (proposition 8, Figure 4.2.g)
- The complementarity of alignment efforts of different classes to overcome a misalignment (proposition 11, Figure 4.2.j).

For cascading sequences of alignment, from the data collected, two reasons were found to explain their occurrence:

- The emergence of an opportunity to improve the outcome of the implementation
- The need to find a solution for further misalignments, created by a previous alignment effort, or uncovered by an initial misalignment, or created by a change in the context of the implementation due to the dynamic nature of the implementation process.

It is possible that both non-linear and cascading sequences of alignment during implementation of technologies in networks of organizations occur for other reasons. Future research can therefore focus on establishing other reasons that may explain their appearance. Furthermore, future research is required to test the propositions that result from the analysis of non-linear sequences of alignment.

The patterns of sequences of alignment identified in the case research also allow us to extract three other main conclusions, concerning the management and the consequences of non-linear and cascading sequences, which we explore next (Sections 4.5.2 and 4.5.3).

4.5. Conclusions

4.5.2 MANAGING NON-LINEAR AND CASCADING SEQUENCES

4.5.2.1 IMPLEMENTATION BOUNDARIES

There are implementation boundaries within which implementation managers may operate. For the implementation of the technology to be possible, there are also assumptions about the operational context of the network in which the implementation will take place. Whenever at the beginning of the implementation these assumptions are not met, a context misalignment emerges. To overcome context misalignments between the technology and the operational context of the network, other types of alignment efforts are required, such as structural and technical alignments, depending on the scope of influence of the misalignment.

The implementation context may also change during the implementation process, a possibility that highlights the dynamic nature of the process. There may be changes in the capacity of organizations in the network, due for instance to higher workloads in other business processes that they are part of, outside the scope of the implementation. These changes may originate misalignments, such as capacity misalignments, that may in turn require further alignment efforts, such as the cancellation of previous reallocations of work among the members of the network (structural alignment efforts).

An additional direction for future research could be the exploration of other effects of the dynamic nature of implementation projects, namely changes in the implementation context, on sequences of alignments.

Context misalignments may also bring unexpected advantages to the implementation, which may be seized by alignment efforts designed to benefit from those advantages. Future research may focus on understanding how alignment efforts may be designed to benefit from such advantages.

4.5.2.2 FLEXIBILITY OF THE IMPLEMENTATION SYSTEM

The previous paragraph brings us to our second conclusion. The implementation system (technology, adopter, and implementation process) has embedded flexibilities that may be of value during the implementation process. Cascading and non-linear sequences of alignment may be interesting instruments to make use of those flexibilities, turning them into desirable sequences with complementary alignment efforts to solve one same misalignment, to transform temporary or improvised alignments into definitive alignments, or to shift misalignments and simplify their resolution.

4. Sequences of alignment between technologies and adopters: Case research of implementations of a new health screening program

Technical alignment efforts are versatile in terms of the types of misalignments that they can address, and the types of alignments that they can enable or complement. When structural misalignments emerge from the implementation of structural alignment efforts, such as traveling difficulties that emerge from a reallocation of work among network members, and it is important to avoid cancelling those structural alignment efforts in order to avoid the reappearance of previous structural misalignments, technical alignment efforts, namely the adaption of business process rules or practices, may be able to overcome (Figure 4.2.c) or reduce the impact of (Figure 4.2.d) the new structural misalignments (traveling difficulties).

Technical alignment efforts may also be important to overcome capacity misalignments that cannot be solved by a capacity alignment. The presence of slack in the network also may be useful to address capacity misalignments, possibly in combination with other types of alignments. Some technical alignment efforts, such as the creation of a new work activity, may be used to transfer the capacity misalignment from a location where it cannot be solved to an alternative location where it can be solved with capacity alignment efforts. Other technical alignment efforts may complement prior capacity alignment efforts to overcome a capacity misalignment. Such technical alignments can be implemented in the organization experiencing the capacity misalignment or in other organizations of the network experiencing the impact of that misalignment.

4.5.3 CONSEQUENCES OF NON-LINEAR AND CASCADING SEQUENCES

Our third conclusion concerns the magnitude of the impact of the alignment efforts. The previous paragraph points out that an alignment effort implemented in one organization may have an impact on other organizations of the network. This is suggestive of one dimension of impact: an alignment effort may have a local impact, affecting only the organization where it takes place, or it may have a more systemic impact, affecting other organizations. Along another cascading dimension, it may have an isolated impact, if it does not create further misalignments, or a combined impact, if it creates one or more cascading sequences.

From the alignment efforts with local impact, some created opportunities for further alignments to improve the outcome of the implementation. For instance, structural alignments, namely the reallocation of work among network members, created the opportunity to implement technical alignment efforts to improve the outcome of the implementation.

4.5. Conclusions

Technical alignments implemented in one organization and intending to solve capacity misalignments may have different impacts (even opposite) on different measures of the implementation outcome, and influence the performance of other organizations in the network. The impacts of technical alignments must therefore be carefully evaluated before being carried out.

A particular case of a technical misalignment in one organization with an impact on another organization consists of a mismatch in boundary rules between two business processes performed by different organizations, namely in the rules limiting the output of one business process and the input of the other. In such cases, capacity misalignments may emerge and the solution for the cascading sequence of misalignments is a technical alignment effort targeting the initial technical misalignment. In the specific case observed in our study, the technical alignment enforced the rules in the organization that performed the first business process, and the capacity misalignment in the organization that performed the subsequent business process was solved.

When a new member is introduced in the network and brings a new business process, a cascading sequence of alignment is likely to emerge, due to the different misalignments that it may create. Integrating a new member in the network (structural alignment) in general requires technical alignments of information sharing means and flows among the organizations in the network. If some existing business processes depend on the new business process, it is also likely that the capacities of the network members operating those business processes need to be aligned. Furthermore, if the capabilities need to be aligned periodically (for instance, before the beginning of each round of the screening), a new business process may be required to support that dynamic behaviour.

The topic of the integration of a new member in the network also suggests interesting directions for future research, namely regarding other dynamics that may originate with the integration of a new member, and the differences that may exist if the new member does not bring a new business process to the network. This was one of the situations in which an initial alignment effort led to multiple cascading sequences. The number and length of cascading sequences created by an alignment effort might be a way to measure the complexity of alignments. However, it was not possible to understand whether this complexity can be predicted, which may also be an interesting direction for future research.

4. Sequences of alignment between technologies and adopters: Case research of implementations of a new health screening program

Evidence from the cases shows that the same alignment effort may have different cascading effects in different networks, depending on the origin of the initial misalignment (the trigger of the alignment effort) and the intent behind the subsequent alignment efforts. In some cases, the cascading sequence of alignments may be unavoidable or even desirable. However, it is always important to carefully and completely evaluate the impact of the alignment efforts on the network of organizations and on the implementation context, to avoid undesirable cascading sequences, such as cascading experiments of alignment efforts. The systematization of the evaluation of the impact of alignment efforts could also be an interesting direction for future research.

4.5.4 NETWORK LEVEL COMPLEXITY

The arguments presented in the discussion of the implications of network-level complexity for implementation management, clearly point to a higher complexity in managing implementations in networks of organizations, when compared to single organizations, in which similar misalignments may emerge but the corresponding alignment efforts only require local, and not network, management, require less negotiation efforts, and only have a local impact, hence easier to evaluate. Summarizing, the following five phenomena contribute to the higher complexity of managing implementations in networks of organizations: the need to negotiate alignment efforts among members of the network before carrying them out; the existence of misalignments in one organization that cannot be overcome locally and affect other organizations, requiring them to carry out alignment efforts; the emergence of misalignments caused by the unfavourable nature of the network; the misevaluation of the global impact of alignment efforts to overcome local misalignments in the multiple organizations of the network; and some organizations not complying with business process rules defined by other organizations.

4.5.5 IMPLICATIONS FOR PRACTICE

A set of managerial and technological recommendations emerges from the discussion and conclusions. Efforts of alignment are generally triggered by a misalignment, i.e., a lack of compatibility between the technology and the network of adopters, or by an opportunity created by previous alignment efforts. In contrast to what may be more intuitive, efforts of alignment of one class may solve or reduce the impact of misalignments of another class. Although misalignments are classified in four classes (context, structural, technical, and

4.5. Conclusions

capacity) and efforts of alignment in three (structural, technical, and capacity), in practice they are interconnected, because they concern the same network of organizations and the same technology. Frequently an alignment effort of one class has consequences on the other dimensions of the network or the technology (other classes), requiring further alignment efforts of different classes.

In particular, when context misalignments exist, at the beginning of the implementation project, the type of alignment efforts required to overcome them depends on the scope of influence of those misalignments. In those cases, implementation managers must:

1. Analyse what is affected by the context misalignment (the structure of the network, the technical operational setting, or the capacities of the organizations)
2. Analyse the potential benefits of the context misalignment that can be of advantage to the implementation process (such as the motivation of professionals to perform some activities in that context, or the existence of routines in some organizations with relevance for the incorporation of the technology in the operations of the network)
3. Design alignment efforts to address what is affected by the context misalignment and take advantage of the benefits that it may offer.

In the findings there is also evidence of technical alignment efforts solving or reducing the impact of context, structural and capacity misalignments, as well as structural alignment efforts needed to overcome capacity misalignments. However, other relations may emerge in different settings of operations.

Alignment efforts may emerge from the observation of behaviours that can inspire changes in practices, such as the changes in scheduling rules observed in non-linear sequence 2.1 of network 8. Similarly, temporary alignment efforts implemented to solve a temporary misalignment may inspire definitive alignments if they happen to contribute to improve some activities.

Generally, before carrying out alignment efforts affecting either the technology or the network of adopters, implementation managers should:

1. Evaluate the complete impact of the alignment effort and its targeted misalignment in the network and in the implementation outcome (namely in its objectives). External variables influencing the implementation system (context of implementation, network, and technology) should be considered in that evaluation, otherwise the

*4. Sequences of alignment between technologies and adopters:
Case research of implementations of a new health screening program*

implementation of the alignment may be ineffective (for instance, when changing the structure of the network, it is important to analyse the distribution of patients in the network and the patient transportation system)

2. Map and divide the predicted impacts of the alignment effort on the different organizations in the network and on the different outcome measures of the implementation, to simplify the subsequent analysis.
3. Assign a score to each impact, reflecting its importance to the implementation project and to the network.
4. Finally, based on the previous analysis, promote the negotiation of the alignment effort between the multiple members of the network.

Our findings also point out that alignment efforts of one class can be complemented by alignment efforts of another class (for instance, capacity alignment efforts may be complemented by technical alignment efforts to overcome capacity misalignments). Over time, as the context of the implementation may change, implementation managers should always be watchful and willing to implement additional alignment efforts, or to cancel previous ones. And, finally, because the technology also evolves, it is important to be kept informed of possible systems that may be complementary to the technology that is being implemented, because some of them may simplify business processes or activities in ways that may overcome existing misalignments.

4.5. *Conclusions*

5 CONCLUSION

This thesis was motivated by the importance of implementations of technologies in networks of preventive healthcare providers, and studied those processes from the perspective of the sequences of alignment between the technology and the adopter. The main goal of the thesis was to improve the current understanding about the dynamics and influences that take place during those sequences of alignment. To achieve this goal, the research was divided in three parts. In a first part, a systematic literature review was conducted to establish the current knowledge base about the topic. The two other parts of the research are framed by the results of the review: one proposed classification schemes for misalignments and alignment efforts, and the other explored in depth two especially important mechanisms in implementations of technologies in networks of organizations – non-linear and cascading sequences of alignment.

The analysis and discussions in those three parts of the research work led to a conceptual framework that systematizes current knowledge about sequences of alignments in implementations of technologies in networks, two classification schemes for misalignments and alignment efforts included in those sequences of alignment, and a set of propositions and recommendations concerning the challenges of implementation management in networks of organizations, namely in what concerns non-linear and cascading sequences of alignment. These results contribute to the technology management literature, namely to the stream concerned with implementations of technologies, and provide some insights for implementation practitioners.

5.1 THEORETICAL CONTRIBUTIONS

Chapter 2 reviews the management research literature concerning efforts to align technology and its adopters during implementations in networks of organizations. The review follows a

5.1. Theoretical contributions

systematic literature review (SLR) method with the aim of understanding what alignment efforts are, where they have an impact during the implementation process, and the management interventions and concerns related to the handling of the alignment process.

Chapter 2 provides a systematic and organized summary of the scientific knowledge about alignment efforts during implementations of technologies in networks of organizations, proposes a conceptual framework to guide future research about the topic, namely by interrelating the constructs found in the literature, and provides a set of promising future research directions, some resulting from the review and others suggested in the literature. The findings provide relevant and strongly supported conceptions about what alignment efforts are, and where they have an impact during implementations in networks of organizations, even though those conceptions need to be tested in other contexts of implementation and with other technologies. The accumulated scientific knowledge about the alignment process also needs to be further tested and detailed. Conversely, findings about alignment management interventions were still scarce and weakly supported, clearly signalling a strong direction for future research.

Another contribution was the proposed separation of alignment efforts in structural and technical alignments. The fact that, although useful, this might be a modest proposal, because alignment efforts may have an impact on several dimensions (such as structures, business processes, existing systems, resources, technology modules, and so on), established the relevance of the work of Chapter 3 towards building classification schemes for misalignments and alignment efforts.

Cascading and non-linear sequences of alignment also emerged as a topic of particular interest for further research, because they appear to be an important and challenging mechanism for implementations of technologies in networks. These findings were important in framing the relevance of the work presented in Chapter 4.

A final expected contribution of this work is the recognition of the importance of this topic in the implementation management literature, which results from bringing together, to the best of our knowledge for the first time, an existing literature that is significantly spread among several journals and disciplines.

Chapter 2 resulted in the following working paper:

- COELHO RODRIGUES, J., CLARO, J., BARROS, A. C. 2016. Aligning technologies and networks in implementation projects: A systematic literature review. *Working Paper*

Chapter 3 proposes two classification schemes, one for classifying misalignments and the other for classifying efforts of alignment between the technology and its adopters during implementation projects. Such classification schemes help establish a structured way to systematize the presentation of findings in future research about this topic, increasing the comparability of results and facilitating the creation of new knowledge based on previous findings. The four classes proposed (context, structural, technical, and capacity, the first not applied to efforts of alignment) were focused on the operational alignment challenges faced throughout technology implementation projects, and were built based on a literature review and on a multiple case research.

Chapter 3 resulted in the following working paper:

- COELHO RODRIGUES, J., CLARO, J., BARROS, A. C. 2016. Classification schemes for misalignments and alignment efforts during implementations in networks. *Working Paper*

Chapter 4 contributes to the understanding of how non-linear and cascading sequences of alignment arise, how they are managed and what their consequences are, during implementations of technologies in networks of organizations. Non-linear and cascading sequences of alignment are important mechanisms in those implementations, in particular because they open possibilities for overcoming the different types of misalignments faced in implementations, and they reveal how the proposed classes of misalignments and alignment efforts are interconnected. This chapter conceptualizes how non-linear and cascading sequences of alignment emerge during implementation projects, what their consequences in the implementation process are, and how they are managed, based on a multiple case research. It also contributes to network theory with findings that reveal that the relation between centralization and the promotion of rules or norms that govern the network, already theorized in the network theory literature concerning the governance level of the network, is also observed at the operational level of the network.

5.1. Theoretical contributions

Chapter 4 provides a set of propositions that resulted from the discussion about the non-linear sequences of alignment, and a thorough discussion about cascading sequences of alignment. The findings offer a rich picture of the challenges of implementation management in networks of organizations. Non-linear and cascading efforts are frequently part of the same sequence of alignments, as can be realized from the references to cascading effects during the discussion of some non-linear sequences, and by the fact that almost all observed cascading sequences include non-linear sequences of alignment. Non-linear sequences of alignment generally arise from alignment efforts that derive from other classes of alignments or misalignments, or from efforts of alignment carried out as substitutes or complements of other classes of alignments or misalignments. Six general reasons were found for the appearance of non-linear sequences of alignment:

- The existence of a context misalignment
- The opportunity to improve the implementation outcome, triggered by an alignment of another class
- The impossibility of solving a misalignment with an alignment effort of the same class
- The cascading effect of an effort of alignment or a misalignment with impacts on other dimensions of the implementation
- The opportunity to carry out an alignment effort that transfers a misalignment of another class from a location where it cannot be solved to a location where it can be solved
- And the complementarity of efforts of alignment of different classes to overcome a misalignment.

Concerning cascading sequences of alignment, two reasons were found to explain their appearance:

- The emergence of an opportunity to improve the outcome of the implementation
- The need to find a solution for further misalignments, created by a previous alignment effort, or uncovered by an initial misalignment, or created by a change in the context of the implementation due to the dynamic nature of the implementation process.

From the patterns of sequences of alignments identified in the case research, three further conclusions concerning the management and consequences of non-linear and cascading sequences were observed:

- There are implementation boundaries within which implementation managers operate. Implementation managers cannot change the external context of implementation and have to plan efforts of alignment within those implementation boundaries.
- The implementation ecosystem has flexibilities that may be valuable throughout the implementation process. Cascading and non-linear sequences of alignment may be interesting instruments to make use of those flexibilities, turning them into desirable sequences with complementary alignment efforts to solve one same misalignment, to transform temporary or improvised alignments into definitive alignments, or to shift misalignments and simplify their resolution.
- Finally, efforts of alignment have different magnitudes of impact in the implementation project. An alignment effort may have a local impact, only affecting the organization where it is carried out, or it may have a more systemic impact, affecting other organizations in the network. Furthermore, it may have an isolated impact, when it does not create further misalignments (cascading sequences), or a combined impact, when it creates one or more cascading sequences.

Chapter 4 resulted in the following working paper:

- COELHO RODRIGUES, J., CLARO, J., BARROS, A. C. 2016. Sequences of alignment between technologies and adopters: Case research of implementations of a new health screening program. *Working Paper*

5.2 PRACTICAL IMPLICATIONS

The conceptual framework proposed in Chapter 2, complemented with the classification schemes for misalignments and alignment efforts proposed in Chapter 3, and the recommendations concerning the management of sequences of alignment proposed in Chapter 4, can guide implementations of technologies from the adoption decision stage until the routinization and acceptance of the technology in the operations of the network.

The structure of the conceptual framework is consistent with the practice of the implementation process. It relates the important concepts and constructs throughout the three

5.2. *Practical implications*

stages of the implementation process (adoption decision, implementation and assimilation), and considers the important factors that influence the implementation and the alignment process.

Throughout this thesis, several considerations retrieved from the literature and from the findings of the case research contribute to implementation management in practice. A first important point is the fact that, in an initial stage of use, a new technology might be outperformed by the existing operations due to misalignments between the technology and the network, because the processes required to use the technology are not yet assimilated in the operational routines of the adopter. Second, when analysing and evaluating the impact of misalignments, it is important to consider that some of them may be beneficial to the network, in particular when they bring a higher systematic order into the operations. Managers should also have a sense of the adopter's structure, technical setting, and capacity in place at the beginning of the implementation to compare with those required to use the technology and identify misalignments as soon as possible. A good and early understanding of the characteristics of the technology and the adopter enables managers to better evaluate the need for alignment efforts in any or both of them, and thus better plan the implementation.

Efforts of alignment are generally triggered by a misalignment, i.e., a lack of compatibility between the technology and the network of adopters, or by opportunities created by previous alignment efforts. In contrast to what may be more intuitive, efforts of alignment of one class may solve or reduce the impact of misalignments of another class. Although misalignments are classified in four groups (context, structural, technical, and capacity) and efforts of alignment in three (structural, technical, and capacity), in practice they are interconnected, because they concern the same network of organizations and the same technology. Frequently an alignment effort of one class has consequences on the other dimensions of the network or the technology (other classes), requiring further alignment efforts.

Alignments can be complemented by efforts of alignment of another class. Over time, as the context of implementation may change, implementation managers should always be watchful and willing to implement additional alignment efforts, or to cancel previous ones. Moreover, as technology evolves, it is important to remain aware of possible systems that may be complementary to the technology that is being implemented, because some of them may simplify business processes in ways that may overcome existing misalignments. Chapter 4

concludes by suggesting a general procedure for managers to follow before carrying out efforts of alignment, changing either the technology or the network:

1. Evaluate the complete impact of the alignment effort and its targeted misalignment in the network and in the implementation outcome
2. Map and divide the predicted impacts of the alignment effort on the different organizations in the network and on the different outcome measures of the implementation, to simplify the subsequent analysis.
3. Assign a score to each impact, reflecting its importance to the implementation project and to the network.
4. Finally, based on the previous analysis, promote the negotiation of the alignment effort between the multiple members of the network.

5.3 LIMITATIONS

This thesis has several limitations, which are described in the following paragraphs and are important to frame the value of the contributions.

The key limitations of Chapter 2 concern the possibility that some relevant papers have been excluded from the review because they did not fit our search and inclusion criteria. Papers might have been excluded because their journal has been labelled as a technical journal and the paper has not been cited by any of the 41 papers included in the review, or because their journal is not indexed in Scopus or in Web of Science, or because the paper has not been written in English, or because the authors refer to alignment or implementation using other terms (although this was carefully addressed through initial exploratory reviews of the three main research topics: network, implementation, and alignment).

Chapter 3 has similar limitations to those presented for Chapter 2, because part of the results derive from a literature review. Part of the retrieved papers and results of this literature review are shared with the SLR. However, literature about implementations of technologies in single organizations was included as well. The search had similar criteria to the search performed for the SLR, but without the terms restricting the search to implementations in networks of organizations. The procedure for data analysis was similar to, but simpler than, the one used in the SLR, because the focus of the research was simply to establish classification schemes for misalignments and efforts of alignment. Accordingly, and because the procedure did not follow all the requirements of a SLR, it was simply a comprehensive

5.4. *Future work*

literature review. In this review, some relevant papers might have been excluded as well, for the same reasons presented for the SLR of Chapter 2.

Chapter 3 and Chapter 4 have limitations related to the case research design. Concerning the generalizability of findings, although generalizations from a case research (in this case eight case studies) might have limited reliability, the case research allowed rich and in depth descriptions to clarify the type of complex processes that are faced during implementations of technologies in networks, based on a variety of data sources. The case research was conducted in the context of the implementation of a health screening program, but in several networks, with representation of variations in four dimensions, which improved the generalizability of the inducted theory. Nevertheless, research in other contexts of implementation may provide additional support and a valuable refinement to the theoretical contributions of this thesis.

The findings of the case research were based on retrospective data concerning what had occurred since the beginning of the implementations until the date of the interview. This created difficulties for some interviewees in remembering how the implementation developed, because in some networks the screening had been in implementation already for a few years, and because the screening is only one part of their work, and most of the times not even a daily activity. These are common limitations of retrospective studies. Future research could enhance the findings of this research by conducting longitudinal research in similar implementation projects. Nevertheless, addressing this limitation was one of the reasons why several professionals were interviewed in each network, so that they could complement each others' information.

A broader limitation of this work is the fact that, given the complexity of implementation projects, as briefly discussed in Chapter 1, this thesis was focused on exploring specific phenomena (misalignments and alignment efforts) and specific sequences of alignment (non-linear and cascading sequences). Future research should, therefore, expand this work by considering greater depth, as well as different phenomena of the implementation processes.

5.4 FUTURE WORK

Several directions for future research have been identified and proposed at the end of each chapter. In general, future research is needed to test and expand the findings of this research in other contexts of implementation, namely for other implementations of similar health

screening programs in the same or in other networks of healthcare providers, and for implementations of different technologies in other networks of organizations, including networks in other industries.

The classification schemes for misalignments and efforts of alignment proposed in Chapter 3 are focused on operational alignment challenges. Future research should extend these classification schemes to include other dimensions of alignment, such as cultural or strategic alignment.

From another perspective, it would be worthwhile exploring whether different classes of misalignments and different sequences of alignment may have different impacts on each of the multiple dimensions of the implementation outcome. Future research should also systematize the evaluation of the impacts of efforts of alignment.

From a practitioner perspective, tools for representing misalignments should be investigated, in order to provide framework(s) that can assist implementation managers in identifying misalignments. In addition, the SLR has revealed that research on what managerial interventions are appropriate for the different phenomena observed throughout the implementation process is still scarce.

Context misalignments might bring unexpected advantages to the implementation, which may be seized by carrying out efforts of alignment specifically designed to benefit from those advantages. Future research may focus on understanding how such efforts may be designed.

Concerning non-linear and cascading sequences of alignment, it would be relevant to continue to identify reasons for the emergence of such sequences, and to explore whether the number and length of cascading sequences created by an alignment effort could be a measure of the complexity of alignments, and whether that complexity can somehow be predicted. Furthermore, future research is required to test the propositions that result from the analysis of non-linear sequences of alignment.

In order to expand the understanding about implementations of technologies, future research should explore other effects of the dynamic nature of such projects, namely the effects that changes in the implementation context may have on sequences of alignments, in order to improve contingency planning. A multi-level perspective of the implementation process would also be of great value for research and practice, in order to systematize the complex

5.4. Future work

dynamics of influences between factors at the different levels of implementation projects (networks, organizations, and individuals).

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7 APPENDIX A

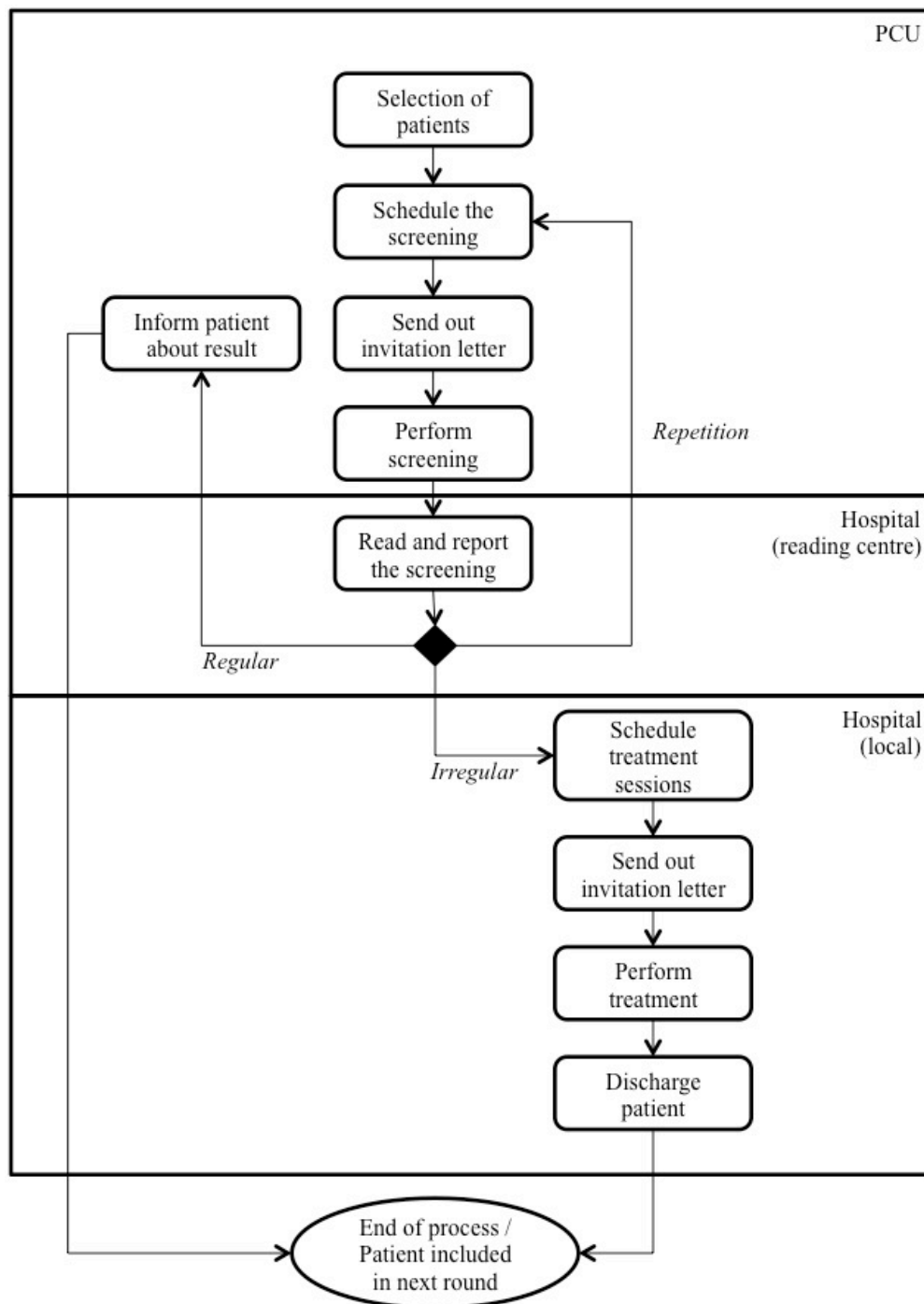


Figure 7.1 – Screening process defined by the RHA

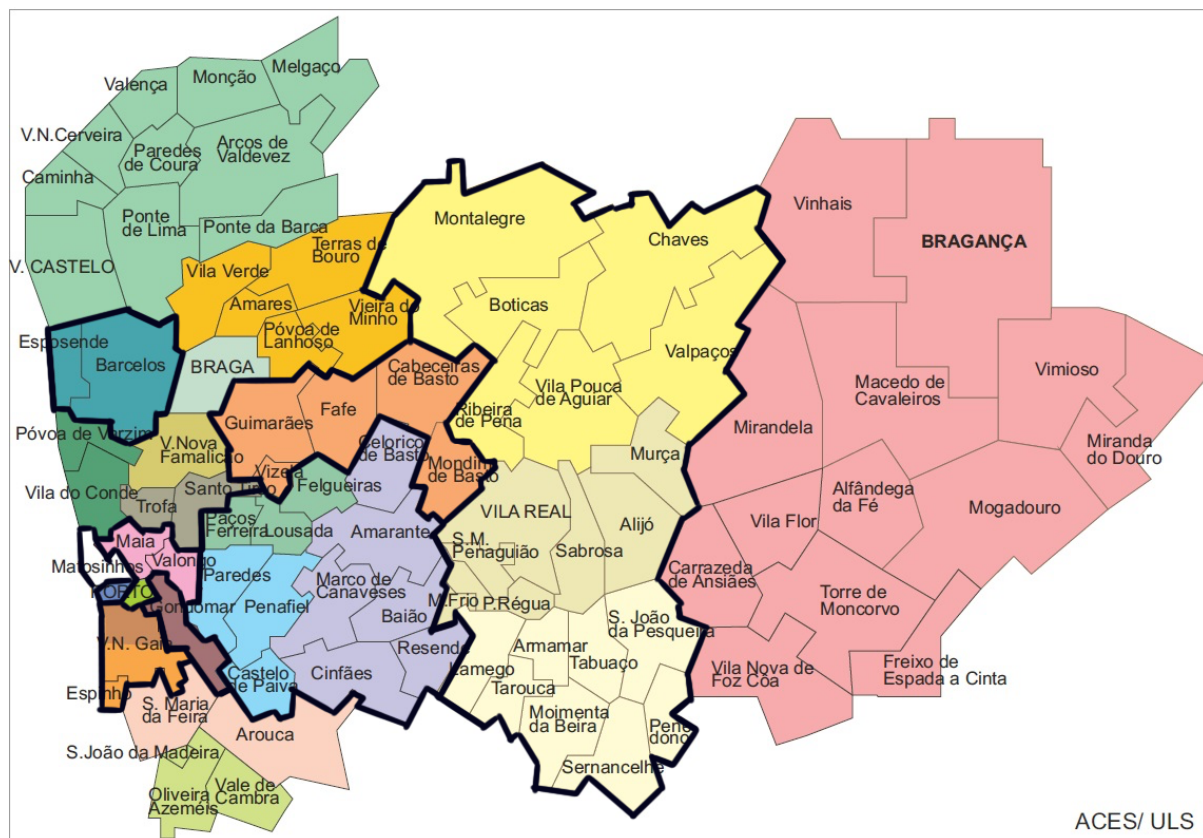


Figure 7.2 – Map of PCC groups in the North of Portugal (the networks included in this research are marked)

8 APPENDIX B – PROTOCOL USED IN THE CASE RESEARCH

(In Portuguese)

PROTOCOLO DOS ESTUDOS DE CASO

JOSÉ COELHO RODRIGUES, INESC TEC

Introdução ao estudo de caso e propósito do protocolo

Este estudo de caso insere-se num estudo sobre implementações de novas tecnologias com impacto em redes interorganizacionais da área da saúde, que está a ser conduzido pela Unidade de Inovação e Transferência de Tecnologia do INESC TEC.

Novas tecnologias, como novos programas de rastreio (em que a tecnologia é a metodologia utilizada para a realização do rastreio), têm contribuído para o aumento da qualidade dos cuidados de saúde preventiva prestados pelo Serviço Nacional de Saúde. Para que essas tecnologias cheguem a contribuir para esse aumento da qualidade do serviço de saúde prestado, é essencial que a sua implementação seja bem gerida. Por outro lado, durante a implementação de um rastreio, que envolva várias instituições organizacionais (como por exemplo, a Administração Regional de Saúde do Norte – ARSN –, os Agrupamentos de Centros de Saúde – ACES – e os Hospitais), poderão surgir necessidades de realizar ajustes técnicos e estruturais ao rastreio e à rede de realização do rastreio. Por exemplo, poderá surgir a necessidade de ajustar o procedimento utilizado para rastrear os pacientes, de forma a adaptar o rastreio à realidade local ou regional; ou poderá ser necessário formar alguns dos intervenientes no processo de rastreio para ganharem novas competências profissionais necessárias para o bom funcionamento do processo; ou poderá surgir a necessidade de iniciar um novo tipo de interação entre duas das instituições participantes no processo, como a criação do envio de um novo relatório do ACES para a ARSN.

Com esta perspetiva, neste estudo, pretende-se encontrar relações entre os ajustes técnicos e estruturais que tenham ocorrido durante a implementação do rastreio e o sucesso dessa implementação, a influência que esses ajustes tiveram nas decisões de gestão da implementação do rastreio, e o papel moderador que as práticas de gestão tiveram nas relações entre os ajustes e o sucesso da implementação. A Figura 1 ilustra graficamente a ferramenta conceptual que estabelece as relações de influência e moderação que se procura confirmar com este estudo. (Mais informação sobre a ferramenta conceptual de base teórica utilizada durante este estudo encontra-se num artigo científico, que pode ser pedido a qualquer dos investigadores deste estudo.)

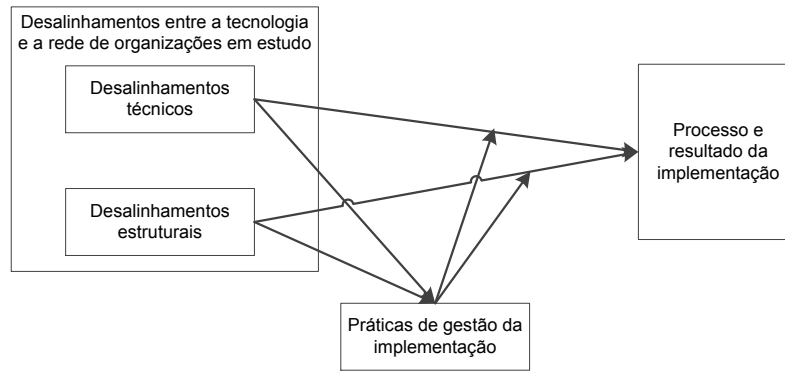


Figura 1 – Ferramenta conceitual (relações que se procura confirmar e entender)

Os casos de estudo dos rastreios da retinopatia diabética e do cancro do colón do útero começaram a operar na região norte de Portugal a partir de 2010 e 2008, respetivamente. Foram implementados com a orientação do Dr. Fernando Tavares, da ARSN e envolvem pelo menos três instituições: um ACES, a ARSN e um Hospital, que têm que interagir, pelo menos para articulação da informação sobre os pacientes rastreados. Mais informação sobre estes e outros rastreios implementados pela ARSN pode ser encontrada em:

<http://portal.arsnorte.min-saude.pt/portal/page/portal/ARSNorte/Conte%C3%BAdos/Planeamento%20Estrategico/Rastreios/Programas%20de%20rastreo%20na%20Regi%C3%A3o%20Norte%20-%20apresenta%C3%A7%C3%A3o.pdf>

Este protocolo serve de guião para a condução da investigação deste e dos demais casos de estudo que se venham a realizar. Podem aqui ser encontradas informações sobre os procedimentos que são esperados utilizar-se para a recolha dos dados, as questões principais que se pretendem ver respondidas com as entrevistas e a estrutura base do relatório resultante de cada estudo de caso.

Procedimentos de recolha de dados

Quem entrevistar

- ARSN – coordenador e gestores da implementação do rastreio | pessoas envolvidas na divulgação do rastreio | pessoas envolvidas no controlo da execução do rastreio (controlo da seleção de utentes a realizar o rastreio e controlo da agenda dos retinógrafos) | pessoas que deram formação

Appendix B – Protocol used in the case research

- ACES –médicos envolvidos na seleção e validação de elegibilidade dos utentes | administrativos responsáveis pela gestão do contacto com o utente | técnicos que realizam os rastreios
- Hospitais (leitura) – médicos que avaliam os resultados do rastreio
- Hospital (tratamento médico) – especialista que recebe os utentes encaminhados para o Hospital depois do rastreio

Previsão do número de entrevistas: utentes: ARSN: 2 a 3; ACES: 2; Hospital (leitura): 2 a 3; Hospital (tratamento médico): 2 a 3.

Previsão da duração de cada entrevista: 20 a 40 minutos.

Plano de recolha de dados

É esperado que a maior parte dos dados recolhidos seja proveniente das entrevistas conduzidas com base nas questões seguidamente apresentadas. É importante que sejam executadas entrevistas a vários intervenientes da mesma categoria profissional de cada instituição, sempre que possível, para garantir a validade científica dos dados recolhidos. As entrevistas serão gravadas sempre que possível, o que garante maior qualidade dos resultados da análise posterior ao estudo de caso. As entrevistas serão conduzidas por dois investigadores, o que permitirá evitar enviesamentos de entendimentos de cada investigador.

Qualquer documentação utilizada durante os rastreios e sua implementação que possa ser dispensada é uma importante fonte de confirmação e complementação dos dados recolhidos durante as entrevistas. O formato da documentação transmitida entre instituições, como por exemplo os relatórios realizados para fins de controlo dos rastreios e para fins estatísticos, pode ser de grande importância para a aferição das interações entre as instituições, do processo de rastreio e do resultado da implementação. Toda a documentação de gestão respeitante aos rastreios, nomeadamente documentação sobre os planeamentos dos projetos de implementação (como os manuais do rastreio destinados aos profissionais envolvidos no rastreio), é também de grande importância para a análise dos casos. Adicionalmente, notícias sobre os rastreios poderão ser também utilizadas para cruzamento de informações

Preparação das visitas/entrevistas

As visitas/entrevistas aos profissionais estão sujeitas à disponibilidade dos entrevistados. Os entrevistados deverão ser informados antecipadamente sobre o propósito da entrevista, que só

decorrerá com seu consentimento. Um termo de consentimento, que garante que os entrevistados têm toda a informação sobre a sua participação no estudo e que nele participam de forma voluntária, é incluído em anexo.

Antes da entrevista, será dado um enquadramento do projeto aos entrevistados. Uma vez que a entrevista se focará em acontecimentos já passados, ainda que não há muito tempo, o enquadramento deverá ser feito com a antecipação necessária para os entrevistados se prepararem para a entrevista.

Cada entrevista terá uma introdução geral ao projeto, algumas questões gerais sobre o funcionamento do rastreio, sobre o seu processo desde a seleção dos utentes até ao resultado do rastreio, sobre a rede de instituições e as relações entre essas instituições, algumas questões sobre a gestão da implementação do rastreio, sobre desalinhamentos entre a tecnologia e a rede de instituições e, finalmente, questões específicas sobre o papel do entrevistado neste processo e a sua perspetiva sobre o grau de sucesso da adoção do rastreio. Dependendo do papel do entrevistado no processo de rastreio, poderá ser-lhe pedido que exemplifique o processo todo de rastreio para um utente sem problemas detetados e para um utente com problemas detetados.

Será pedido antecipadamente acesso à documentação e aos sistemas de informação utilizados no rastreio, sempre que tais possam ser consultados.

Estrutura do relatório do estudo de caso

1. Introdução geral ao estudo
2. Descrição do rastreio e contexto do estudo de caso (rede de organizações, resultado até à data...)
3. Material desenvolvido
 - 3.a. História (resumo) do caso
 - 3.b. Modelo lógico do rastreio
 - 3.c. Modelo organizacional da rede de organizações
 - 3.d. Resultados extraídos do caso
 - 3.e. Lista de entrevistados
 - 3.f. Lista de documentos relevantes

9 APPENDIX C – INFORMED CONSENT

(In Portuguese)

CONSENTIMENTO INFORMADO, LIVRE E ESCLARECIDO PARA PARTICIPAÇÃO EM INVESTIGAÇÃO

de acordo com a Declaração de Helsínquia⁷ e a Convenção de Oviedo⁸

Por favor, leia com atenção a seguinte informação. Se achar que algo está incorrecto ou que não está claro, não hesite em solicitar mais informações. Se concorda com a proposta que lhe foi feita, queira assinar este documento.

Título do estudo: Implementação de inovações tecnológicas em redes de organizações prestadoras de cuidados de saúde.

Enquadramento: Projeto de investigação no âmbito do Programa Doutoral em Engenharia Industrial e Gestão (PRODEIG) da Faculdade de Engenharia da Universidade do Porto (FEUP), orientado pelo Professor Doutor João Alberto Vieira de Campos Pereira Claro, que envolve o estudo da gestão de implementação de inovações tecnológicas em redes de organizações prestadoras de cuidados de saúde. Foram selecionadas para servir de casos de estudos implementações de rastreios preventivos que aconteceram nos últimos anos. O estudo implicará o envolvimento das várias instituições pertencentes às redes responsáveis pelas implementações dos rastreios: a Administração Regional de Saúde do Norte (ARSN), como entidade responsável e gestora da implementação, algumas Unidades de Saúde Familiar (USF) e alguns Hospitais (H) pertencentes às redes, como entidades operacionais dos rastreios.

Explicação do estudo: Neste estudo será utilizada a metodologia de estudo de caso. A implementação de cada programa de rastreio será um estudo de caso diferente, por exemplo, a implementação do rastreio da retinopatia diabética será um estudo de caso. Dentro de cada estudo de caso haverá replicação das unidades de análise para confirmação dos dados observados. Por exemplo, no caso da implementação do rastreio da retinopatia diabética, cada rede centrada numa USF onde se realizam os rastreios é uma unidade de análise, que será composta por essa USF, pela ARSN e por um ou dois Hospitais (centro de leitura e Hospital de tratamento). Em cada estudo de caso e para cada unidade de análise é previsto que se entrevistem os intervenientes responsáveis pela implementação e os intervenientes que sejam diretamente afetados pelo rastreio. Por exemplo, no caso do rastreio da retinopatia diabética, prevê-se entrevistar: os utentes convocados para o rastreio, a equipa de implementação, controlo e execução do rastreio da ARSN, os médicos e os administrativos da USF envolvidos no rastreio, um médico especialista de um Hospital que seja leitor do resultado do rastreio e um médico especialista do Hospital que seja responsável pelos tratamentos dos pacientes encaminhados pela USF.

É esperado que a maior parte dos dados recolhidos seja proveniente destas entrevistas conduzidas com base em tópicos ou questões centradas na gestão e implementação da inovação (o rastreio). Esses tópicos ou questões serão sujeitos a validação por parte da ARSN. As entrevistas serão conduzidas por dois investigadores, o que permitirá evitar enviesamentos de entendimentos de cada investigador. As entrevistas poderão ser realizadas presencialmente, caso em que os investigadores se poderão deslocar ao local de trabalho dos participantes, ou telefonicamente, consoante for mais conveniente para ambas as partes. As entrevistas serão gravadas sempre que possível, para garantir maior qualidade dos resultados na análise posterior. As entrevistas terão durações variadas consoante o tipo de participante: se for um responsável pela implementação do rastreio é esperado que a entrevista seja mais longa e dure aproximadamente 60 minutos, uma vez que nestes casos se procurará recolher informações detalhadas sobre o processo e a gestão da implementação; se for um interveniente diretamente afetado pela implementação espera-se que a entrevista seja mais curta e dure entre 15 a 30 minutos, uma vez que a intenção será recolher alguns dados qualitativos acerca de perceções sobre o processo e a gestão da implementação. Cada entrevista será realizada uma única vez, com a possibilidade de ser necessário algum contacto posterior para confirmação ou complementação dos dados. A seleção dos participantes e das instituições a incluir no estudo será realizada juntamente com a ARSN (entidade que gere e implementa o rastreio), procurando selecionar instituições em que a implementação tenha sido recente e selecionar os participantes mais afetados pela implementação.

Está previsto que o estudo se conclua até julho de 2014. Todas as gravações das entrevistas serão armazenadas num espaço de trabalho pessoal, protegido, até um ano após essa data. As gravações serão então destruídas.

⁷ http://portal.arsnorte.min-saude.pt/portal/page/portal/ARSNorte/Comiss%C3%A3o%20de%20%C3%89tica/Ficheiros/Declaracao_Helsinki_2008.pdf

⁸ <http://dre.pt/pdf/sdip/2001/01/002A00/00140036.pdf>

Para além das entrevistas e com vista a triangular (confirmar) os dados recolhidos, serão também pedidos os documentos produzidos durante a implementação da inovação, sobre a gestão e a execução dessa implementação e os documentos ou o tipo de dados transmitidos entre as instituições durante a utilização da inovação (durante o programa de rastreio). Por exemplo, para o caso do rastreio da retinopatia diabética, o manual de procedimento para esse rastreio é extremamente importante para a compreensão do funcionamento do rastreio e das preocupações de implementação. Ainda nesse caso, a visualização dos sistemas de informação de apoio ao rastreio poderão ser muito importantes para compreender que novas rotinas tiveram que ser criadas. Também os dados estatísticos recolhidos pela ARSN sobre a utilização da implementação serão extremamente relevantes para compreensão da evolução da adoção da inovação no terreno. Todos estes dados serão, tal como as gravações das entrevistas, armazenados num espaço de trabalho pessoal, protegido, até um ano após a data de conclusão do estudo e, depois, eliminados desse espaço.

Os resultados deste estudo serão incluídos numa tese no âmbito do referido Programa Doutoral.

Condições e financiamento: Este estudo é financiado pelo INESC TEC (INESC Tecnologia e Ciência, antigo INESC Porto), instituição de acolhimento do investigador que conduz este estudo. A participação nas entrevistas é voluntária, pelo que o participante tem o direito de não responder a qualquer questão e terminar a entrevista em qualquer momento por qualquer razão. Além disso, a permissão para gravar a entrevista poderá ser revogada em qualquer momento. Não serão comportadas compensações monetárias, financeiras ou outras de natureza material.

Este estudo mereceu o parecer favorável da Comissão de Ética para a Saúde da ARSN.

Confidencialidade e anonimato: A informação recolhida é confidencial. A identidade dos participantes não será revelada em quaisquer relatórios ou publicações resultantes deste estudo. Não serão usados os nomes dos participantes ou qualquer outra referência em concreto às suas pessoas. Todos os dados recolhidos serão exclusivamente utilizados para o presente estudo. Caso se verifique o abandono desta investigação os dados recolhidos serão eliminados no prazo de um mês após a comunicação ao entrevistado. Todos os contactos com os participantes serão realizados em ambientes de privacidade, procurando assegurar a confidencialidade das informações recolhidas.

São endereçados os agradecimentos à ARSN pela abertura ao acolhimento deste estudo, pela facilitação no estabelecimento dos contactos e da disponibilização do tempo dos seus colaboradores, aos profissionais das unidades de saúde (ARSN, USFs e Hospitais) que se dispõem a ser entrevistados para este estudo, e ao INESC TEC por financiar este projeto, assim como providenciar os recursos necessários para o seu desenvolvimento.

Para quaisquer dúvidas ou questões sobre o estado do estudo, em qualquer momento, é favor contactar:

José Coelho Rodrigues

jose.c.rodrigues@inescporto.pt

Tlm: +351 919 643 392

Assinatura:
.....

-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-

Declaro ter lido e compreendido este documento, bem como as informações verbais que me foram fornecidas pela/s pessoa/s que acima assina/m. Foi-me garantida a possibilidade de, em qualquer altura, recusar participar neste estudo sem qualquer tipo de consequências. Desta forma, aceito participar neste estudo e permito a utilização dos dados que de forma voluntária forneço, confiando em que apenas serão utilizados para esta investigação e nas garantias de confidencialidade e anonimato que me são dadas pelo/a investigador/a.

Nome:

Assinatura:

Data: /..... /.....

**ESTE DOCUMENTO É COMPOSTO DE 2 PÁGINAS E FEITO EM DUPLICADO:
UMA VIA PARA O INVESTIGADOR, OUTRA PARA A PESSOA QUE CONSENTE**

10 APPENDIX D – INTERVIEW GUIDES

(In Portuguese)

Guião de entrevista – Equipa de coordenação (ARS Norte)

Introdução

Entrevista inserida num estudo realizado pelo INESC TEC, instituto de investigação científica, em parceria com a Administração Regional de Saúde do Norte (ARS Norte), sobre a implementação e execução do programa de rastreio da retinopatia diabética na região norte. Esta entrevista é mais exaustiva, uma vez que o estudo se centra na gestão da implementação e esta é a equipa que gere a implementação, daí ser a equipa com mais informação a fornecer para o estudo. As restantes entrevistas destinam-se a confirmar os dados recolhidos nas entrevistas à equipa de coordenação do rastreio. O início desta entrevista foca-se na gestão de desalinhamentos sentidos durante a implementação já que o estudo centra a análise da gestão de implementação numa perspetiva de gestão de desalinhamentos que ocorrem durante a implementação. No resto da entrevista procurar-se-á também abordar algumas questões sobre o processo de rastreio, importante para conhecer bem o procedimento de rastreio a ser implementado, e algumas questões mais abertas sobre a gestão da implementação, para recolher maior detalhe sobre a atividade da equipa de coordenação, para além da gestão dos desalinhamentos.

1. Como se despoletou o início do programa de rastreio? (Como é que tudo começou?)

Grande parte dos esforços de implementação são focados em resolver desalinhamentos operacionais entre a tecnologia ou a inovação que se encontra em implementação e o ambiente operacional em que os utilizadores já realizam as suas tarefas diárias. Os desalinhamentos podem ser estruturais, quando a estrutura de rede interorganizacional existente e a necessária para utilizar a tecnologia não se encontram alinhadas, ou técnicos, quando as capacidades ou tarefas que já existem na rede de organizações não se encontra alinhada com as necessidades ou tarefas necessárias para utilizar a tecnologia.

Desalinhamentos estruturais: desalinhamentos entre a estrutura organizacional existente (se existir) na rede e a estrutura necessária para operacionalizar o rastreio. (Entende-se que a estrutura da rede é composta pelo número de organizações, tipo de organizações e ligações existentes entre as organizações. As ligações entre as organizações correspondem às relações que existem na execução do rastreio e poderão ser distinguidas por importância que tenham para a realização do rastreio).

2. Como estava pensada inicialmente a estrutura da rede de organizações para a realização do rastreio? Que entidades ou organizações? Quantas organizações de cada tipo? Como se relacionam (como estão ligadas)? Como é o processo de rastreio?
3. Que estrutura já existia? Que entidades ou organizações já se relacionavam? Que tipo de relação (ligação) já tinham?
4. Que novas organizações foram introduzidas na rede para que o rastreio funcionasse? Como as introduziram? Que precauções foram tomadas? Porquê? Aconteceu da mesma forma em todas as redes?
5. Que alterações ocorreram nas relações (ligações) entre as organizações? Como aconteceram? Que precauções tomaram? Estas alterações aconteceram da mesma forma para todas as redes?
6. Fizeram alguma alteração à estrutura do rastreio para se adaptar às redes que já existiam? Que alteração? Porquê? Como o fizeram? A alteração afetou todas as redes?
7. Conseguem medir ou têm medido de alguma forma os resultados (operacionais) destas alterações / adaptações? Qual o resultado?
8. As alterações / adaptações ocorreram em organizações centrais para o rastreio ou em organizações cujo papel é mais periférico?

Desalinhamentos técnicos: desalinhamento entre as capacidades / conhecimentos e/ou tarefas existentes nas organizações da rede e as capacidades / conhecimentos e/ou tarefas necessárias para realizar o processo de rastreio. Estes desalinhamentos podem também dever-se a uma distribuição das capacidades /conhecimentos / tarefas entre as organizações da rede desalinhada relativamente à distribuição necessária para realizar o rastreio.

9. Que capacidades / conhecimentos e tarefas são necessários em cada organização para realizar o rastreio? Como é esperado que estejam distribuídas?
10. Quais as que já existiam antes do rastreio começar a ser implementado? Onde? Como eram distribuídas?
11. Sentiram ou chegou até vós informação de alguma dificuldade por parte dos profissionais envolvidos em realizar as suas tarefas no rastreio? E em entender a importância da realização do rastreio? E de o rastreio ser algo organizado como está a ser implementado?

12. Que novas ou alterações nas tarefas / nos conhecimentos / nas capacidades / nos papéis dos profissionais foram introduzidos ou tiveram que ser promovidos? Porquê? Quem o fez? Como o fizeram? Foi igual em todas as redes?
13. Que alterações o adaptações fizeram no rastreio para se adequar melhor à realidade profissional existente nas redes? Foi igual para todas as redes?
14. (Houve alguma parte ou informação do procedimento que não estivesse inicialmente incluída e tenha sido incluída mais tarde? Qual?)
15. Conseguem medir ou têm medido de alguma forma os resultados (operacionais) destas alterações / adaptações? Qual o resultado?
16. As alterações / adaptações ocorreram em atividades / tarefas / capacidades / conhecimentos centrais ou periféricos para o rastreio?

Outras preocupações e práticas da gestão:

17. Que outras ações têm realizado na gestão da implementação?
 - a. Como executaram?
 - b. Quem executou?
 - c. Quando?
 - d. Porquê?
 - e. Para quê?
 - f. Para quem?
 - g. Foi planeado?
18. Há algum tipo de seguimento sistemático do impacto do rastreio nas redes de cuidados?
19. Que formas de recolha de informações do campo operacional são utilizadas? Para além dos dados estatísticos recolhidos, recebem comentários dos intervenientes? Quais? Quando? De quem?
20. Que preocupações tiveram com a comunicação do rastreio? Em que altura?
21. Que tipo de tratamento dão às propostas que vos chegam?

Processo de rastreio:

22. Havia algum rastreio “informal” aos diabéticos antes do programa iniciar? Isso influenciou de alguma forma o procedimento desenvolvido?
23. A captação dos utentes é feita automaticamente pelo software de apoio a este rastreio? Há alguma integração com o SINUS? Que esforços envolveu?

24. Como foi escolhido / desenvolvido o software? Quando e porque foi escolhido?
25. Na seleção de utentes para o rastreio, cada utente é selecionado pelo seu médico de família?
26. Qual o papel do médico de família no programa de rastreio após a primeira seleção?
27. Onde é que o administrativo do centro de saúde vê os novos casos selecionados para serem rastreados? E onde é que regista a hora de chegada no dia do rastreio? No software deste rastreio ou no SINUS?
28. Há alguma tecnologia que suporte a realização da calendarização de instalação dos retinógrafos? Como é feita essa alocação?
29. Quando o resultado do rastreio dá “Não classificável”, que tipo de seguimento dão a esse caso?
30. Como é feita a convocatória do tratamento (entre ULS ou UCSP e Hospital)?
31. Onde é registada a marcação e a execução do tratamento, no software? Ou é alimentado pelo sistema do Hospital?

Operacionalização na ARS Norte, enquanto atores no rastreio:

32. Que novas tarefas surgiram na ARS Norte com o programa de rastreio da retinopatia diabética?
33. Como foi a introdução dessas tarefas pela primeira vez no seu trabalho?
34. Sente alguma dificuldade em realizar as tarefas adicionais que o programa impõe?
35. Como foi a sua adaptação a esta nova realidade? E ao software? Sentiu necessidade de alguma formação?
36. Pode identificar que etapas houve ou tem havido desde o início do programa de rastreio e durante a sua operacionalização?
37. No âmbito deste procedimento, tem alguma interação com as restantes instituições envolvidas no programa (para além das trocas de informações e relatórios pelas aplicações informáticas)? Como acontecia antes do programa?
38. Houve necessidade de aquisição de novos conhecimentos nas instituições da rede? E na ARS Norte? O que foi feito nesse sentido? Por quem? Quando?
39. Que outros tipos de preparativos foram ou têm sido efetuados?
40. Que alterações ao procedimento é que proporia ou propôs? Quando propôs? Porquê? O que resultou da proposta?
41. É um “entusiasta” do rastreio? Porquê? Em que é que isso altera o seu empenho neste programa?

Resultado do programa:

42. Em termos gerais, qual o resultado do rastreio? Qual o impacto na performance operacional nas redes? O rastreio está em pleno funcionamento? Está-se a tirar proveito do seu pleno potencial?
43. Da sua percepção, que impacto é que a introdução do programa de rastreios teve nas várias instituições?
44. Que benefícios trouxe o programa?
45. O que não funciona bem no programa? Porquê? Há alguma solução pensada?

Guião de Entrevista – Médico de família

Introdução

Entrevista inserida num estudo realizado pelo INESC TEC, instituto de investigação científica, em parceria com a ARS Norte, sobre a implementação e execução do programa de rastreio da retinopatia diabética na região norte.

1. Que tarefas realiza no âmbito do programa de rastreio da retinopatia diabética?
2. Como foi a introdução dessas tarefas pela primeira vez no seu trabalho?
3. Sente alguma dificuldade, na altura de execução do rastreio, em realizar as tarefas adicionais que o programa impõe? Que tipo de dificuldade? Porquê?
4. Como foi a sua adaptação a este novo “procedimento”? E ao software? Sentiu necessidade de alguma formação?
5. O que é que este programa de rastreio mudou na forma como aborda os seus pacientes diabéticos, nomeadamente no que respeita à prevenção da retinopatia diabética?
6. Antes do programa de rastreio, como fazia quando suspeitava que um seu paciente necessitaria deste rastreio?
7. Pode identificar que etapas houve ou tem havido desde que ouviu falar no programa de rastreio e durante a sua operacionalização?
8. No âmbito deste procedimento, tem alguma interação com as restantes instituições envolvidas no programa para além das trocas de informações e relatórios pelas aplicações informáticas? Como acontecia antes do programa?
9. Que alterações ao procedimento é que proporia ou propôs? Porquê? Quando? Houve alguma alteração resultante de uma sua proposta?
10. Que benefícios trouxe o programa?
11. O que não funciona bem no programa?
12. É um “entusiasta” do rastreio?

Guião de Entrevista – Administrativo do Centro de cuidados primários (ULS ou UCSP)

Introdução

Entrevista inserida num estudo realizado pelo INESC TEC, instituto de investigação científica, em parceria com a ARS Norte, sobre a implementação e execução do programa de rastreio da retinopatia diabética na região norte.

1. Que tarefas realiza no âmbito do programa de rastreio da retinopatia diabética?
2. Como faz a gestão das marcações e remarcações com as restantes unidades? E a gestão de marcação do tratamento com o Hospital? Faz algum tipo de arranjo de transporte ou outro tipo para o paciente?
3. Que mudanças nas interações com outras unidades e com o Hospital é que este programa lhe trouxe?
4. Como foi a introdução dessas tarefas pela primeira vez no seu trabalho?
5. Sente alguma dificuldade, na altura de execução do rastreio, em realizar as tarefas adicionais que o programa impõe? Que tipo de dificuldade? Porquê?
6. Como foi a sua adaptação a este novo “procedimento”? E ao software? Sentiu necessidade de alguma formação? Teve-a?
7. Pode identificar que etapas houve ou tem havido desde que ouviu falar no programa de rastreio e durante a sua operacionalização?
8. No âmbito deste procedimento, tem alguma interação com as restantes instituições envolvidas no programa para além das trocas de informações e relatórios pelas aplicações informáticas? Como acontecia antes do programa?
9. Que alterações ao procedimento é que proporia ou propôs? Porquê? Quando? Houve alguma alteração resultante de uma sua proposta?
10. Que benefícios trouxe o programa?
11. O que não funciona bem no programa?
12. É um “entusiasta” do rastreio?

Guião de Entrevista – Técnicos de ortóptica

Introdução

Entrevista inserida num estudo realizado pelo INESC TEC, instituto de investigação científica, em parceria com a ARS Norte, sobre a implementação e execução do programa de rastreio da retinopatia diabética na região norte.

1. Que tarefas realiza no âmbito do programa de rastreios da retinopatia diabética?
2. Como foi a introdução destas tarefas pela primeira vez no seu trabalho?
3. Sente alguma dificuldade em realizar as tarefas adicionais que o programa lhe impõe?
Que tipo de dificuldade? Porquê?
4. Como foi a sua adaptação a este novo “procedimento”? E ao software? Sentiu necessidade de alguma formação?
5. Houve algum tipo de procedimento que ainda não tivesse realizado e que agora realize neste programa? Nos que já realizava, que alterações sentiu? Concorda com essas alterações? Melhoraram a execução do exame?
6. Antes do programa de rastreio, como fazia os exames a este tipo de pacientes?
7. Pode identificar que etapas houve ou tem havido desde que ouviu falar no programa de rastreio e durante a sua operacionalização?
8. Como gere as suas interações com as restantes instituições envolvidas no programa?
Como acontecia antes do programa?
9. Como gere os utentes ou pedidos imprevistos no seu plano de trabalho? Como gere as faltas dos utentes?
10. Que comentários faz às condições de trabalho que tem (local, amenidades...)?
11. Como é a sua relação com a equipa coordenadora da ARS Norte (comunicação, normas, procedimentos...)? Gostaria que esta se alterasse de alguma forma?
12. Que benefícios trouxe o programa?
13. O que não funciona bem no programa?
14. Que alterações ao procedimento é que proporia ou propôs? Porquê? Quando? Houve alguma alteração resultante de uma sua proposta?
15. É um “entusiasta” do rastreio?

Guião de Entrevista – Médicos leitores

Introdução

Entrevista inserida num estudo realizado pelo INESC TEC, instituto de investigação científica, em parceria com a ARS Norte, sobre a implementação e execução do programa de rastreio da retinopatia diabética na região norte.

1. Que tarefas realiza no âmbito do programa de rastreios da retinopatia diabética?
2. Como foi a introdução dessas tarefas pela primeira vez no seu trabalho?
3. Sente alguma dificuldade em realizar as tarefas adicionais que o programa lhe impõe?
Que tipo de dificuldade? Porquê?
4. Como foi a sua adaptação a este novo “procedimento”? E ao software? Sentiu necessidade de alguma formação?
5. Antes do programa de rastreio, fazia leituras destes exames a pacientes que não eram seguidos por si?
6. Pode identificar que etapas houve ou tem havido desde que ouviu falar no programa de rastreio e durante a sua operacionalização?
7. No âmbito deste procedimento, tem alguma interação com as restantes instituições envolvidas no programa para além das trocas de informações e relatórios pelas aplicações informáticas? Como acontecia antes do programa?
8. Que alterações ao procedimento é que proporia ou propôs? Porquê? Quando? Houve alguma alteração resultante de uma sua proposta?
9. Que benefícios trouxe o programa?
10. O que não funciona bem no programa?
11. É um “entusiasta” do rastreio?

Guião de Entrevista – Médicos especialistas (tratamento)

Introdução

Entrevista inserida num estudo realizado pelo INESC TEC, instituto de investigação científica, em parceria com a ARS Norte, sobre a implementação e execução do programa de rastreio da retinopatia diabética na região norte.

1. Que tarefas realiza no âmbito do programa de rastreio da retinopatia diabética?
2. Como foi a introdução dessas tarefas pela primeira vez no seu trabalho?
3. Houve alguma alteração aos procedimentos de consulta de tratamento deste tipo de pacientes? Qual? Porquê?
4. Sente alguma dificuldade em realizar as tarefas adicionais que o programa impõe? Que tipo de dificuldade? Porquê?
5. Antes da introdução do programa de rastreios, como é que os pacientes vinham ter consigo? De onde eram encaminhados e em que casos? Houve melhorias (encaminhamento mais atempado...)?
6. Como foi a sua adaptação a este novo “procedimento”? E ao software? Sentiu necessidade de alguma formação?
7. Pode identificar que etapas houve ou tem havido desde que ouviu falar no programa de rastreio e durante a sua operacionalização?
8. No âmbito deste procedimento, tem alguma interação com as restantes instituições envolvidas no programa para além das trocas de informações e relatórios pelas aplicações informáticas? Como acontecia antes do programa?
9. Que alterações ao procedimento é que proporia ou propôs? Porquê? Quando? Houve alguma alteração resultante de uma sai proposta?
10. Que benefícios trouxe o programa?
11. O que não funciona bem no programa?
12. É um “entusiasta” do rastreio?